THE EFFECTS OF INDUCED MENTAL IMAGERY ON THE COMPREHENSION AND RETENTION OF CONTENT AREA MATERIAL: A STUDY CONDUCTED WITH HIGH RISK COLLEGE STUDENTS

By

SHERRIE LEE NIST

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by

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To Kama

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THE EFFECTS OF INDUCED MENTAL IMAGERY ON THE COMPREHENSION AND RETENTION OF CONTENT AREA MATERIAL: A STUDY CONDUCTED WITH HIGH RISK COLLEGE STUDENTS

By

Sherrie Lee Nist

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This study was undertaken to determine the effects of induced mental imagery on the comprehension and retention of content area material and to determine if one content area appeared more appropriate for the use of imagery than another.

The sample consisted of 41 high risk college students who were randomly assigned by classes to one of three groups: imagery, directed reading activity (DRA), or no instruction. The imagery group received two one-hour training sessions in imaging techniques. Over a five-week period all groups were given three 1,100 word content area passages to read, one from biological science, one from social science, and one from literature. The imagery group was given "warm-up" exercises and then was encouraged to use imaging strategies. The DRA group received instruction with a traditional directed reading activity. The no instruction group received no guidance from the researcher.

Following the reading of each passage, all groups answered a series of 18 multiple-choice comprehension questions. One week following the initial reading of each passage, the groups took an 18-item retention test parallel to the comprehension test. An imagery questionnaire administered at the conclusion of the investigation sought to determine if subjects used the imaging strategies throughout the course of the experiment.

Data were analyzed using a split-plot repeated measures design with one covariate consistent across all repeated measures. The imagery questionnaire was analyzed with a chi-square test of significance.

While the results indicated a main effect for test, passage, and group, an interaction between passage and group was also present. Further analyses revealed that for high risk college students imagery was equally effective for the three types of content area materials and that those in the imagery group scored consistently higher than the two control groups on all passages. Analysis of the imagery questionnaire indicated that while all students tended to image spontaneously, they often did not image to their academic advantage. This finding further supports the importance of imagery training.

CHAPTER I
INTRODUCTION

As numbers of non-traditional students have proliferated in colleges and universities across the United States, developmental and remedial reading courses have followed suit. Students enrolled in such programs represent a diversity of cultural and experiential backgrounds, and are expected to ease eventually into the academic mainstream. Since the materials they are required to read are from a variety of content areas, teachers are constantly seeking effective strategies that are appropriate for helping these students acquire the reading skills they need to achieve academic success.

Statement of the Problem

The purpose of this study was to investigate the effects of induced mental imagery on the comprehension and retention of content area material. The study was conducted with high risk college students using reading passages from three disciplines: biological science, social science, and literature. Since the passages were found to be equivalent in length, readability, and imaging value, this study also tried to determine if mental imagery techniques are more effective for any of the three disciplines. Additionally, an imagery questionnaire administered at the conclusion of the experiment attempted to determine if those trained in imaging techniques actually used them, and if students in the two control groups imaged spontaneously.

Significance of the Study

Reading courses for non-traditional students in colleges and universities are looked upon as answers for solving students' reading problems--methods of easing students into the academic mainstream. Programs have often been hastily instituted with little foresight and planning for their stability (Chaplin, 1978). Today, college populations remain diverse, but the practices that seemed effective in a period of change are no longer relevant or beneficial to sustaining the existence of college reading programs (Chaplin, 1978).

There are several possible explanations for the failure of current college reading programs. First, there is the problem of the lack of transfer of the skills taught in a reading course to application of these skills for reading materials required in other courses taken by students. This is especially true in a highly individualized laboratory setting where students are often assigned numerous, repetitive exercises supposedly designed to strengthen reading skill weaknesses.

A second explanation for the failure of college reading programs stems from the fact that materials used in laboratory programs are often poor in quality and limited in quantity. Such materials fail to contain reading selections that are similar in length, content, and difficulty to the texts in required academic courses.

A third, and possibly the most neglected explanation for the lack of success of many college reading programs, is the relationship that world knowledge--an experiential framework--has on the college students' abilities to obtain meaning from the printed page. Although present reading research addresses the importance of world knowledge in children's comprehension, little research has explored its importance with college-age students who have reading problems.

Concomitant with the relationship between experiential background and comprehension is the influence that mental imagery has on the comprehension and retention of prose material, as well as the importance that perceptual world knowledge plays in one's ability to image textual propositions. The whole realm of imagery becomes even more significant for high risk students who are unaware that they can use imagery as a viable means for increasing reading comprehension and retention. If students were taught or merely made aware of imaging techniques, it might be possible for students to subsequently relate these images to personal past perceptual experiences, and, thus improve their comprehension and retention of content area material. Therefore, this study has the potential for being both educationally and theoretically significant.

Theoretical Significance

The majority of the research in the area of mental imagery has been conducted by psychologists. There is little agreement in this field regarding the nature of images and the function they serve in comprehension and retention. While most psychologists would agree that the hypothetical structure called "imaging" exists, essentially two different schools of thought emerge in their view of imagery as a form of internal representation.

The first school is concerned with images as a structurally distinct form of internal representation possessing a different format from other internal representation; the second focus is concerned with images as a functionally distinct form of internal representation (Kosslyn and Pomerantz, 1977).

In studies conducted from both theoretical positions exploring the use of imagery with prose material, retention rather than comprehension has been the focus. All of the studies cited in the Review of the Literature (Chapter II) use the terms "recall" and "comprehension" synonomously. Typically, subjects are instructed to form images, are given a passage to read, and are directed to engage in a recall task (either immediate or delayed) following the reading of the passage. The subjects are not permitted to refer to the reading selection. The question remains: Is a recall task or a recognition task a true test of comprehension, or is it, in fact, a retention or short term memory task? For the purpose of this study, a comprehension task is defined as one where subjects read the selection and then have access to the passage when answering the comprehension items. On the other hand, the retention task occurs one week following the initial reading of the passage and allows no access to the passage. The distinction made between comprehension and retention should clarify the role that imagery plays in reading textual materials; that is, is imagery functional in acquisition?

Crowder (1976) makes the following distinction which focuses on the differences among acquisition, retention, and retrieval and serves to clarify why comprehension and recall are differentiated in this study. He states

> If performance on a memory task is perfect, of course one can be assured that information has been successfully learned by the subject. . . . The central problem occurs when there is a failure of retrieval. Such a failure brings up a very fundamental ambiguity: One has no idea whether the information has been (1) acquired adequately and retained adequately but is for some reason inaccessible at the time of attempted retrieval; (2) acquired adequately but then lost (forgotten) during the time elapsing between acquisition and retrieval; or finally (3) acquired inadequately in the first place so that there is nothing there to retain or retrieve. (p. 4)

Additional support for this viewpoint comes from Gibson and Levin (1976). When addressing the matter of comprehension, they make the following statement:

> Recall, either verbatim or free, does not suffice [to assess comprehension], and almost any measure raises questions of validity, reliability, and generalizability to any other material or task. (p. 409)

Thus, while the majority of studies report significant differences in favor of those who use imagery techniques on the retention task than those who do not, the relationship between imaging and comprehension is much less clear. Does imagery enable comprehension to occur? Must comprehension occur prior to imagery? Does imagery imply comprehension? That is, could imagery and comprehension be synonomous terms? Is there an overlap of the two processes?

This study may aid in clarifying the relationship between imagery and comprehension. It may further support one of the three theoretical perspectives above.

Educational Significance

There are several reasons why this study is educationally significant. First, there is an immediate need for new approaches for teaching reading at the college level, particularly for high risk students. In the few longitudinal studies which have been conducted, there is evidence that the standardized test gains made by students enrolled in college reading programs are not permanent (Gaither, 1968; Katz and Wright, 1977). Not only do these studies indicate a lack of permanence, but they also indicate that much of what is taught is not transferable to reading material required for regular college courses. These studies demonstrate the importance of investigating new techniques and approaches to facilitate comprehension and retention which will be both permanent and transferable.

Second, there is a lack of research in the area of mental imagery as related to the comprehension and retention of prose material, especially at the college level. Much of the research in the area of mental imagery has been conducted in paired-associate learning. Research in paired-associate learning has been conducted with college students, but even here, most subjects were enrolled in introductory psychology courses. This type of individual would be atypical of the student enrolled in most college reading courses. In addition, a major portion of this research has little relationship to reading in that the word pairs were presented orally rather than visually, making them, for the most part, exercises in memory (Paivio, Yuille, and Madigan, 1968; Bugelski, 1968; Paivio, Smythe, and Yuille, 1968; Paivio, 1969; Kee and Beuhring, 1978).

Studies in mental imagery have also been conducted using phrases and sentences rather than paired-associate tasks. The greater portion of this research has been carried out using elementary students as subjects, and results have been encouraging (Levin, 1971; Kosslyn and Bower, 1974; Levin et al., 1976; Montague and Hess, 1978). In studies that have been carried out with older subjects, results have also been positive (Paivio and Begg, 1971; Anderson, 1971; Begg, 1972).

The investigation of the use of mental imagery at the prose level is particularly interesting due to the controversy involved. On one hand there are studies which support the use of mental imagery as a viable means of facilitating comprehension and retention (e.g., Levin, 1972; Lesgold et al., 1974-1976). Other studies indicate that just the opposite is true (e.g., Irwin and Witte, 1980). Upon examination of these studies, certain patterns emerge.

First, the importance of explicit instructions in how to use imaging techniques appears to be an important factor in the effectiveness of imagery as a learning strategy. A study by Anderson and Kulhavy (1972) reported that scores on a test of retention were an increasing function of the amount of imagery that was reportedly used. All too often, subjects are merely instructed to use imagery but are not actually taught how to carry out this task. If Anderson and Kulhavy's findings are true, it seems only logical to assume that students rely on other less effective reading strategies if they have not learned to use imagery.

Second, there appear to be differences in retention when induced imagery is used as opposed to imposed imagery, and these differences appear to be developmental in nature. Levin (1972) found that imposed imagery is initially less effective than imposed verbalization in younger children, but that the former becomes more effective with age. The same appears to be true for induced imagery versus induced verbalization. Along these same lines, Levin (1972) also concluded that adults respond to induced imagery much more readily than do children. Since adults were used as subjects in the present investigation, induced rather than imposed imagery was utilized.

Of the articles reviewed, few were found in reading journals; if reading textbooks devote any space at all to the idea of mental imagery, it is mentioned only in passing. Therefore, it is important to begin to relate psychological theories of mental imagery to the reading process. Durrell and Catterson (1980) state the need for more empirical research in mental imagery as well as the importance it serves in comprehension as follows:

> The richness of imagery flow, especially in reading fiction, is probably the most important aspect of comprehension. Unfortunately, it is frequently ignored in current professional scholarship. (pp. 21-22)

They continue by stating that imagery will play a major role in the future of reading. Thus, the area of imagery deserves much more attention from those in the reading profession than it is currently receiving. This may be especially true at the college level where virtually 80 percent of all learning involves reading (Baker, 1974).

The results of this study may help to establish the feasibility of using mental imagery in group situations as an aid to both the comprehension and retention of content area material for students at the college level, particularly high risk students.

Definition of Terms

The following terms are defined in relationship to their use in this study:

Mental imagery, imaging, visual imagery. Mental imagery, imaging, and visual imagery are all used synonomously. These terms refer to the innate ability of the mind to form patterns, mental structures of concepts, objects, processes, events and relationships which result from perception of the world.

Mental imagery techniques, imaging techniques, visual imaging techniques. Mental imagery techniques, imaging techniques, and visual imagery techniques are all used synonomously. These terms refer to the procedures used to teach students to image what is read.

Learning strategies. Learning strategies are devices to aid in the understanding of, retention of, and retrieval of information read.

Retention. Retention is defined as the ability to retain or remember information read seven days previously, as measured by an 18 item multiple-choice test.

Comprehension. Comprehension is defined as the ability to answer a series of multiple-choice questions following the reading of each of three passages. Students had access to the passage when they answered the questions and they were encouraged to refer to the selection for clarification or verification.

High risk students. High risk students are those students who are strongly recommended to enroll in a college level reading course due to scoring below a cutting score of the 35th percentile on the Nelson-Denny Reading Test.

Induced imagery. Induced imagery is a strategy taught to students prior to reading a passage in the form of an instructional set supplied by the experimenter. The students are not provided with different representations of particular items, but rather with a general set to generate their own images (Levin, 1972). Example: The students are asked to image the word "chair" in such a way that it is meaningful to them, but the researcher gives no instructions as to what the chair looks like. The students image what will best help them to comprehend and to retain what is read about the subject.

Imposed imagery. Imposed imagery is a strategy in which experimenters suggest images which they perceive as characteristic of the learning passage. Example: The students are instructed to image a specific kind of chair (i.e., "a wooden, straight back chair with a green seat").

Interactive images. Interactive images are defined as the combination of two or more images on the formation of a third image in the mind.

Paired-associate task. A paired-associate task is one in which students are presented successively a collection of discrete item pairs. The students must focus on each pair as a separate unit, with the success of their performance dependent upon the degree to which stable associations within the pairs are generated (Levin, 1972).

Assumptions

In this study it was assumed that

1. Subjects had the intellectual ability and the skills to decode the words in the passages.

2. Subjects in the imagery group could be trained to use the imaging techniques.

3. Any subject loss was unrelated to the treatment.

4. Subjects received no special reading instruction other than that provided in the developmental course.

5. While every effort was made to ensure that the length, readability, and imaging value of the passages were equivalent, the possibility of an ordering effect may exist. This assumption is especially true when using a split-plot repeated measures design.

Delimitations and Limitations

The delimitations of the study are 41 students voluntarily enrolled in a developmental reading course at Central Florida Community College during the spring semester, 1982. Since individuals taking this course are generally high risk students, the results of this study can be generalized only to individuals meeting this criterion.

Procedures

Instrument Development

Three content area passages--"The Long, Cold Sleep" (1966) by Harold Schmeck, a biological science passage, "Immortality Syndrome" (1966) by James Gollin, a social science passage, and "Filboid Studge, the Story of a Mouse that Helped" (1966) by H. H. Munro, a literature passage--were selected for use in this study. Multiple-choice items were written and field tested on 114 high risk college students for the comprehension and retention questions. At the same time subjects rated each passage for imaging value as measured by the Voss-Newell Imagery Rating Scale (1977). Passage difficulty was determined through the use of the Fry Readability Formula (1968). Kuder-Richardson 20 reliability coefficients were also determined for the comprehension test items written for each passage. A vocabulary pretest and posttest were also developed for each selection, as was an imagery questionnaire.

The Study

Collection of the data

The study sample consisted of 41 high risk students voluntarily enrolled in a developmental reading course at a local community college. The original sample size was 47 but due to absenteeism, 41 individuals had complete data which could be used in the analyses. Subjects were randomly assigned by classes to one of three conditions. Group 1, the experimental group, contained 14 subjects and was trained in imaging techniques; Group 2, a control group, contained 13 subjects and was instructed using a directed reading approach; Group 3, which contained 14 subjects, received no instruction and served as a second control group. Scores on the Nelson-Denny Reading Test (Brown, Nelson, and

Denny, 1973) were obtained for all subjects. The comprehension score of the Nelson-Denny Reading Test was used to test for equivalency of the groups. It also served as a covariate in the statistical analysis.

Over a five-week period, each group read the three content area selections and answered a series of 18 multiple-choice comprehension items for each passage. One week following the initial reading, all subjects also took a parallel 18-item retention test. The only difference between the two tests was that both the items and the foils were reordered.

A follow-up imagery questionnaire was administered to all groups upon completion of the data collection. This questionnaire was primarily designed to determine if those in the experimental group actually used imaging strategies and if subjects in the other groups imaged spontaneously.

Design and statistical analysis

This study utilized a two-trial factor, one grouping factor split-plot repeated measures design with one covariate consistent across all repeated measures. The two trial factors were the type of passage (biological science, social science, or literature) and the type of test (comprehension or retention). Group membership (imagery, directed reading activity, or no instruction) served as the grouping factor. The raw score of the comprehension subtest of the Nelson-Denny Reading Test served as the covariate and was employed to eliminate variation associated with reading comprehension. The data were analyzed using a packaged program from the Biomedical Computer Programs, p-series (Jennrich and Sampson, 1979). When the null hypothesis was rejected, follow-up comparisons were calculated.

Analysis of the descriptive data obtained from the follow-up imagery questionnaire was carried out using a packaged program from Statistical Analysis System (Helwig, 1978). These data are reported according to frequency of subject response and a chi square test of significance.

Hypotheses

The following major hypotheses, stated in the null form, were tested in this study. Follow-up analyses were conducted when statistical significance was found. All hypotheses were tested at the .05 level of significance.

Hypothesis I: After eliminating variation associated with reading comprehension as measured by the comprehension score on the Nelson-Denny Reading Test, there is no significant interaction between the type of passage (biological science, social science, or literature), the type of test (comprehension or retention), and group membership (imagery, directed reading activity, or no instruction).

Hypothesis II: After eliminating variation associated with reading comprehension as measured by the comprehension score on the Nelson-Denny Reading Test, there is no significant interaction between the type of passage and the type of test.

Hypothesis III: After eliminating variation associated with reading comprehension as measured by the comprehension score on the Nelson-Denny Reading Test, there is no significant interaction between the type of test and group membership.

Hypothesis IV: After eliminating variation associated with reading comprehension as measured by the comprehension score on the Nelson-Denny Reading Test, there are no significant differences between the scores on the comprehension test and the scores on the retention test.

Hypothesis V: After eliminating variation associated with reading comprehension as measured by the comprehension score on the Nelson-Denny Reading Test, there is no significant interaction between the type of passage and group membership.

Hypothesis VI: After eliminating variation associated with reading comprehension as measured by the comprehension score on the Nelson-Denny Reading Test, there are no significant differences between the combined comprehension and retention scores on the biological science passage, the social science passage, and the literature passage, across all three groups.

Hypothesis VII: After eliminating variation associated with reading comprehension as measured by the comprehension score on the Nelson-Denny Reading Test, there are no significant differences between the combined comprehension and retention scores for Group 1, Group 2, or Group 3 across all passages.

Organization of the Research Report

Chapter II presents a Review of Related Literature. Chapter III describes the methodology used in the study including a detailed description of the instrument development. The data are presented, analyzed, and discussed in Chapter IV, while Chapter V includes a summary, implications and conclusions, and recommendations for further research.

CHAPTER II
REVIEW OF RELATED LITERATURE

Chapter II reviews literature and research in the following five areas relating to the topic of imagery: (1) a historical perspective of imagery, (2) differing theoretical views of imagery, (3) mental imagery and paired-associate learning, (4) mental imagery at the phrase and sentence level, and (5) mental imagery and prose material. While a portion of this research has been carried out with children as subjects rather than with college age students, it nonetheless somewhat clarifies the relationship between imagery and the comprehension and retention of content area material.

Mental Imagery: A Historical Perspective

Since the days of ancient Greece the idea that memory, and possibly understanding, is facilitated by cognitive elaborations has been centrally important in pedagogy and instruction (Wittrock, 1978). One such elaboration technique utilized by early Greeks such as Aristotle, Plato, and Simonides was that of forming mental images as an aid to memory. Aristotle defined "memory" or "remembering" as "a state induced by a mental image related as a likeness to that of which it is an image." (1964, p. 451)

Plato's philosophy was similar to that of Aristotle's. He stated

> Suppose, then, I beg, for the sake of argument, that we have in our souls a waxen tablet . . . whatever is imprinted, this we remember and know, as long as the image remains, but when it is effaced, or is no longer imprinted we forget and do not know it. (1964, p. 296)

The Greek poet Simonides' system for remembering consisted of a mnemonic system designed to facilitate the construction of an ordered series of interactive images. Cicero described the system as follows:

> He (Simonides) inferred that persons desiring to train this faculty (memory) must select localities and form mental images of the facts they wish to remember and store. Those images in the localities will preserve the order of the facts, and the images of the facts themselves, and we shall employ the localities and images respectfully as a wax writing tablet and letters written on it. (Cicero, 1967, p. 354)

The ancient art of mnemonics, such as the method described by Simonides, has survived, and new systems have been created; whereas, the concept of imagery as a means of remembering or understanding has been researched considerably in the area of psychology rather than in education.

The work of Galton (1883) spurred a lively interest in mental imagery among psychologists around the turn of the century. Galton explored the measurement of individual differences in imagery through the use of his now famous breakfast-table questionnaire. His observations led other psychologists to investigate whether thought and memory were a function of the vividness of the images formed. During this particular period when the behavioristic movement was prevalent in psychology, strong objections arose to the claim that imagery had functional significance in behavior (Paivio, 1970). This belief proliferated for two reasons: First, the concept was viewed as unacceptably mentalistic; second, empirical support was lacking (Paivio, 1970). Some researchers, such as Fracker (1908) and Kuhlmann (1907), found that imaging ability enhanced memory for visual forms or colors while others, such as Carey (1915), failed to find such relationships. Betts (1909) was the first to struggle with what is now deemed as imposed and induced imagery. Through his research he speculated that imposed imagery could be studied quantitatively better than induced imagery. Though he researched both aspects, his conclusion suggested imposed imagery as the more favorable method to use. This finding has been challenged by more recent research (e.g., Levin, 1972).

Thus, early research on imagery was conducted using primarily symbols, colors, or verbalizing familiar surroundings. Little, if any, thought had been given to the relationship between the utilization of imagery with printed materials or how imaging techniques could be used to increase comprehension or retention.

Differing Theoretical Views of Imagery

While the major focus of this study does not directly address the question of how information is stored in the brain, the differing views held by theorists deserve brief consideration.

Although the hypothetical construct called mental imagery has been studied extensively by psychologists, there remain vast differences of opinion concerning its structure and function. These differing viewpoints apparently can be divided into two broad categories: the pictorialistics and the descriptionalists (Block, 1981). Both groups agree that there are mental representations; their disagreement arises in explaining the nature of these representations.

The descriptionalists, or anti-imaging group, theorize that all mental representations are descriptional (Block, 1981). Pylyshyn (1973), for example, argues that the processing and storing of images would be cumbersome if not impossible because the amount of information stored (as images) would soon exceed the capacity of the brain. Rather, Pylyshyn, as well as Anderson (1978) and Kintch (1972), theorizes that a propositional account of representation is much more plausible. Propositions are defined as abstract structures (not linguistic) that express precise relations between entities (Kosslyn and Pomerantz, 1977). These theorists argue that since propositions must be either true or false, this format is appropriate for representing knowledge. World knowledge, they contend, consists of a set of assertions which are necessarily true or false, while mental images do not have this quality.

While the pictorialistics do not purport that actual pictures are in the mind, they insist that mental images represent in much the same way that pictures represent (Block, 1981). The pictorialistics can be further divided into the perceptually based theorists and the strong imagery theorists. The perceptually based theorists, who include Bransford and McCarrell (1974), Neisser (1976), and Verbrugge (1980), purport that an object or event can not be imaged unless that object or event or a pictorial representation of that object or event has been perceived. Further, they would argue that faulty imaging is a result of faulty perception.

The strong imagery theorists argue that the need for a pictorial representation is crucial. However, they are not saying that descriptional representations do not exist but that there must also be pictorial representations. Paivio and Csapo (1973), for example, give evidence to support a dual-code theory which claims that mental representation can take two forms. They contend that abstract words or sentences are represented with verbal strings; concrete words or sentences are stored with both a verbal and an imaginal representation, thus enabling easier retrieval.

Kosslyn and Pomerantz (1977) summarize the assumptions of the pictorialistics as follows:

> 1. Images may be generated from underlying abstract representation. The contents of these underlying representations are assessible only via generation of an experienced image. (p. 65)
>
> 2. The same structures that represent spatial information extracted during vision also support images. (p. 66)
>
> 3. Many of the same operators that are used in analyzing percepts are also applied to images. (p. 66)
>
> 4. Images, once formed, are wholes that may be compared to percepts in a template-like manner. (p. 66)

Since the focus of this study is the application of the use of imagery with content area materials, the viewpoint of this study supports the pictorial representation viewpoint. Research which further supports this stand is discussed in the following sections.

Mental Imagery and Paired-Associate Learning

A large portion of the research on mental imagery has been conducted in paired-associate learning. In a paired-associate task a collection of discrete item pairs are presented successively to the learner. The learners must focus on each pair as a separate unit with the success of their performance dependent upon the degree to which stable association within pairs is generated (Levin, 1972).

Paivio's extensive work in imagery and paired-associate learning stresses the importance of the imagery value of a word. In a now classic study, Paivio, Yuille and Madigan (1968) obtained concreteness, imagery and meaningfulness values for 925 nouns. Concreteness was defined in terms of directness of reference to sensory experiences, and imagery was defined in terms of a word's capacity to arouse nonverbal images. Meaningfulness was defined in terms of the mean number of written associations subjects could make in 30 seconds. Both concreteness and imagery were rated on seven-point scales.

In rating the nouns for imagery level the subjects were instructed to rate high any word that easily aroused a mental picture and to rate low any word that did not.

Ratings of concreteness followed the same general procedure. The subjects were instructed to give a high concreteness rating to any word that referred to objects, materials or persons, and a high abstractness rating to any word that referred to an abstract concept that could not be experienced by the senses.

The results of this study on identification of the imagery value of a word indicated that words rated high in imaging value were also high in concreteness. Items rated high on imaging and concreteness were also high in meaning. Additionally, many items were found low in imaging and low in concreteness but relatively high in meaning. This asymmetrical relationship was consistent with other work by Paivio and his associates (Paivio, 1966; Yuille and Paivio, 1968). Their research indicated that abstract items derived their meaning largely from intraverbal associates but not necessarily evoked images. Highly concrete items, on the other hand, presumably were associated with both sensory and verbal experience which were reflected in their high imaging and meaning values (Paivio, Yuille, and Madigan, 1968). This research on the rating of words as possessing either high or low imaging value paved the way for more credible research in paired-associated learning, retention and retrieval.

Bugelski (1968) conducted an experiment using 36 senior psychology majors. Subjects were assigned to one of two groups. Subjects in Group 1 (experimental group) were asked to memorize a nursery jingle. After reciting the jingle five times in a row correctly, subjects were shown how it could aid them in learning lists of ten words. They were to imagine the first word in the jingle as related in some way to the first word on the list, the second word in the jingle to the second word on the list and so on. Subjects in Group 2 (control group) were left to their own devices as to how they would learn the ten words. As expected, the learning scores of experimental subjects were clearly and significantly superior for each of the six lists than scores of the control group. Bugelski explained these findings by suggesting that verbal interference occurred from repeating the ten words. What he possibly overlooked was the fact that the words from all six lists were concrete nouns with very high imaging values, and were, therefore, more appropriate for learning through imaging than through verbalization. Additionally, since the control group received no specific instructions, it would naturally be assumed that any strategy was better than none.

Paivio, Smythe,and Yuille (1968) conducted an experiment to investigate paired-associate learning as a function of high and low level stimuli. When noun imagery was varied in one list, meaning in a second, and the two were covaried in a third, reported imagery was strongly related to noun imagery, particularly of stimulus members, whereas, verbal mediators and repetition showed no such patterns. A correlational analysis involving item attributes, learning scores, and frequency of reported mediators for individual items over all three lists, confirmed the inference that the strongest relationships were between reported use of imagery and the learning scores when the items served as stimulus members of pairs. Furthermore, reported imagery correlated significantly with learning even with stimulus imagery partialed out increasing the plausibility of the argument that associations were in fact mediated by imagery (Paivio, 1969).

A 1970 study by Bower investigated imagery versus overt rehearsal (verbal repetition of pairs of words) in paired-associate learning. Subjects were 30 high school graduates solicited from a local newspaper advertisement. Group 1 received instructions for using overt repetition, Group 2 for using an interactive imagery strategy, and Group 3 for using a non-interactive imagery strategy. All words were nouns with high imagery values selected from the norms published by Paivio, Yuille, and Madigan (1968). There were 90 pairs shown in three lists of 30 pairs, each pair visually displayed for ten seconds.

The subjects first rated the likelihood that each word had appeared on a list of a prior study (recognition), and second, if the subjects thought the word had appeared on a prior list in the study, subjects tried to recall the other word paired with each word shown. Each list received one study trial followed by one test trial. Although recognition scores across the three groups showed no significant differences, the differences between conditions in recall were quite substantial. The group instructed to use interactive imagery clearly exceeded the separation imagery group and the rote repetition group while the later two conditions did not significantly differ from one another.

More recent studies investigated the use of pictures in paired-associate learning. Kee and Beuhring (1978) and Danner and Taylor

(1971) integrated the use of pictorial representation in imaging relations between separate pictures of nouns. In the Kee and Beuhring (1978) study it was found that when two groups were exposed to verbal presentation (standard versus elaborated) and pictorial representation (standard versus elaborated), both elaborated verbal and elaborated pictorial presentations facilitated noun pair learning as far as acquisition was concerned. Although Kee and Beuhring found no significant differences in subsequent retention of noun pairs, the study did conclude that to sustain the same level of noun pair retention after seven days, the imaging presentation required only half as many study-test cycles.

The Danner and Taylor (1971) study,which attempted to assess the effect of relational imagery developmentally, utilized pictorial relations as well as the combination of relational imagery and pictorial relations to test the recall of noun triplets. The subjects were 100 children from grades one, three, and six. Using a 2 x 3 x 4 factorial design, subjects were assigned to one of four conditions: relational imagery training, unitized pictures, the combination of training and unitized pictures, or a control group receiving neither training nor pictures. The major finding was that all three experimental conditions greatly facilitated recall.

In this chapter certain patterns emerge. First, with few exceptions, imaging techniques tend to facilitate the learning of noun pairs. Second, word pairs that are concrete and high in imaging value tend to be learned with much more ease using a mental imagery technique. Abstract items appear to be acquired more readily through verbal rehearsal or a combination of imaging and overt rehearsal.

The importance of the meaningfulness of a word deserves attention also. Paivio's findings that words can be low in concreteness and imagery value but high in meaningfulness have possible implications. Perhaps the meaningfulness of a word has just as much influence over whether or not a word can be imaged as does concreteness. If multiple meanings for a word can be generated, it would seem that the subject would have several viable alternatives to image. For example, an abstract word such as "democracy" could generate many meaningful associations which could be readily imaged.

Finally, the research cited herein suggests that pictorial representations presented with visual labels tend to aid subjects in imaging the pictorial representation. This procedure serves as an aid in recalling the paired-associated stimulus to a greater degree than a stimulus presented only visually.

Mental Imagery at the Phrase and Sentence Level

As with imagery and paired-associate learning, Paivio was a forerunner in investigating the role that imagery plays in comprehension and retention at the sentence level. Begg and Paivio (1969) attempted to extend the analysis to sentences and contextual meaning. Wanner (1968) reported that subjects were able to recognize changes in sentence meaning almost 100 percent of the time but to recognize changes in wording only at a chance level. Drawing on those findings, Begg and Paivio hypothesized that under natural conditions readers rely on mental imagery to represent concrete sentences, thereby losing the individual words completely. These researchers contended that the opposite holds true for abstract sentences.

Using a 2 x 2 analysis of variance with change type (semantic or lexical) and sentence type (concrete or abstract) as independent factors, 120 college student volunteers listened to 20 sentences with five sentences in each set. After listening to each set of five sentences, the subjects then heard one sentence from the set in one of three ways: (1) in its original form, (2) with semantic changes, or (3) with lexical changes. Subjects were instructed to mark either "identical" or "change" on their answer sheet as well as to rate the confidence of their judgment. Although there were no significant main effects, the predicted interaction was highly significant. Thus, semantic changes were more often noticed than lexical changes in concrete sentences, while the reverse was true for abstract sentences. According to Begg and Paivio these findings indicate the possibility that the imaginal code reduces the memory load for the meaning of concrete sentences. The image permits the organization of the sentence into a single unit, while abstract material is not amenable to unitization. The viewpoint reported in this research is in conflict with the theoretical viewpoint of Pylyshyn (1973) who feels that the storage of images would be too cumbersome.

A study by Montague and Hess (1978) attempted to differentiate between the dominant representation system with regard to imagery versus verbal coding of good and poor readers. Their research drew on the work of Waller (1976), who speculated that poor readers may predominantly use an imagery code while good readers use verbal or other abstract representation, or a combination of both verbal representation and imagery. On the basis of the SRA Assessment Survey total reading score, 90 fourth and fifth grade students were classified as good or poor readers. Task materials, originally developed by Paris and Carter (1973), consisted of nine, three-sentence stories and a set of five sentences per story which were later presented for recognition. Subjects were assigned to one of three treatment groups: imagery-oriented strategy, verbal-oriented strategy, or a control situation. They were instructed to listen to the short stories and then to decide whether the sentences presented later were exactly the same as they had previously heard in the stories. Those assigned to the imagery condition were told to use imagery while listening to the stories ("Picture each story; make up a picture in your mind to go with the story"). A 2 x 3 x 5 analysis of variance showed a significant main effect of reader level and sentence type, but no significant main effect was found for instructions. Montague and Hess suggested several possible reasons for the lack of a significant main effect for instruction. The most plausible reason given was timing. Since the imagery instructions were given after task introduction and a practice trial, subjects may have already adopted strategies before the instructions and were, therefore, not affected by the researchers' instructions. A further explanation not explored by Montague and Hess is that the subjects were not given any instruction on how to form images. This lack of training could have resulted in confusion by the subjects concerning the exact nature of the task they were to accomplish. In addition, children of this age attempting to follow rather vague instructions may concentrate too intensively on forming a suitable image only to lose both the image and the comprehension. This is especially true when the stimulus is presented auditorily and rapidly (Bransford, 1979).

A similar series of experiments conducted by Levin, Ghatala, Guttman, Subkoviak, McCabe, and Bender (1976) was undertaken to determine if those utilizing imagery would score significantly better on a test of 20 multiple-choice items than those who used overt and covert rehearsal, or a control group who was given no specific rehearsal strategies. Means for the four groups (number of correct items out of 20) were 15.19, 9.50, 11.69, and 12.38 respectively. Using a Dunnett comparison, it was found that imagery did facilitate performance and overt repetition inhibited performance. Covert repetition did not differ significantly from the control performance.

Since a significant difference was present in favor of the imagery group, a second experiment was conducted to determine the nature of the errors as well as to verify the results for instruction from Experiment One. Although the significance was not as large as that for the first experiment, a significant difference was once again found in favor of the imagery strategy. The researchers stated that these results may have been due to the fact that Experiment One was based on a recall method of testing while Experiment Two was based on recognition.

Researchers now know the importance of the imagery-evoking value of words (e.g., Paivio, 1966, 1969, 1970). Training in how to form images is necessary if subjects are to utilize fully the technique. Imagery is a more effective elaboration technique than either overt or covert rehearsal.

Mental Imagery and Prose Material

Since mental imagery was found to facilitate retrieval and retention in both paired-associate learning and sentence learning, research was undertaken to determine if imagery was also facilitative with prose material.

Research Undertaken with Children

Levin (1973) was one of the first to explore the effects of imagery on prose learning. Using a modification of his aptitude by treatment interaction model, Levin (1972) hypothesized that good readers typically perform better than poor readers no matter what instructional approach is used, but no less so in some conditions than in others. Subjects were 54 fourth grade students who were designated as either good or poor readers. "Good" readers were those whose reading comprehension score on the Iowa Test of Basic Skills was above grade level; "poor" readers had a reading comprehension score below grade level. Within the poor readers category a further distinction was made between deficit and difference poor readers (Weiner and Cromer, 1967). Those whose vocabulary grade equivalent was less than one year below grade level made up the difference poor group while the remainder comprised the deficit poor group.

According to these classifications, students were randomly assigned to one of three conditions: reading alone, reading with imagery or reading accompanied with pictures. Using a 2 x 3 x 3 factorial design, it was found that imagery instructions were facilitative while the pictorial representation was not. Similarly, good and poor readers differed significantly overall while the two types of poor readers did not. Levin concluded that imagery benefited only those students with adequate basic reading skills but who were in need of an organizational strategy. These findings supported Weiner and Cromer's (1967) distinctions among various types of readers.

An experiment conducted by Levin and Divine-Hawkins (1974) revealed a main effect for instructions and an interaction between the instructions by presentation mode. Subjects were 48 fourth graders who were blocked on reading ability, and then randomly assigned to one of four experimental conditions: listening/regular instructions, reading/regular instructions, listening/imagery instructions, or reading/imagery instructions. Levin and Divine-Hawkins interpreted the results of this experiment by postulating that a reading/imagery conflict arises from the two competing responses occurring simultaneously since subjects were allowed to read the passages at their own pace. A second experiment was designed to investigate this possibility.

In the second experiment (Levin and Divine-Hawkins, 1974), the amount of time allotted for the reading of or listening to the passage was controlled by the experimenter. The slow rate was seven seconds per sentence while the fast rate was three and one-half seconds per sentence. Results indicated that more imagery was reported at the slow rate rather than at the fast rate. At the slow rate imagery-instructed subjects reported more imagery than regular-instructed subjects. The effect of instructions per se was not significant. At the fast rate much more imagery was reported in the listening than in the reading conditions regardless of the instructions given. The researchers concluded that even though the instructions by presentation mode interaction of Experiment One was replicated in Experiment Two, this does not permit unqualified support that visual imagery is more compatible with listening than with reading.

Pressley (1976) investigated the use of mental imagery with 86 eight-year-olds using prose material that was typical of the type which third-graders would encounter in their everyday school work. Subjects in the experimental condition were taught imaging techniques, while those in the control group were instructed to do whatever they could do in order to remember. Using a 2 x 2 analysis of variance, Pressley found a significant effect due to the experimental condition and no interaction between reading ability and treatment conditions.

Pressley offers various interpretations of these data. First, he stresses the importance of training and practice in forming mental images. When this procedure is followed, an easily imaginal story can be improved by using mental imagery. Second, since the conditions of this experiment closely approximated a typical classroom reading group, this study did suggest the plausibility of teaching imagery techniques in the classroom in order to improve comprehension and retention. Finally, there exists the possibility that imagery may not be as facilitative in prose learning especially in good readers who may already process prose well. For poorer readers, however, imagery instructions seemed beneficial.

Some controversy exists in this area, however. Levin (1973) found that imagery instructions were beneficial only for those in need of an organizational strategy. This assumption may be well-founded; if subjects have decoding or vocabulary problems, imagery would probably contribute little to increase comprehension or retention. Pressley, however, suggested further investigation into the effects of imagery with poor readers.

Kulhavy and Swenson (1975) conducted an experiment with 128 fifth and sixth grade students. Half of the subjects were instructed to form mental images of the text during reading while the other half were instructed to read carefully. Findings were consistent with the previously cited studies in that grade school children remember more from a text if they employ mental images while reading. In line with the original prediction, it was concluded that imagery instructions act to increase the amount of text content available over time. Kulhavy and Swenson also agreed with Pressley (1976) concerning the feasibility of teaching imaging techniques in the classroom. It should be pointed out, however, that none of the researchers suggest that the use of mental imagery should be the only strategy employed; rather, it provides the teacher with yet another alternative for increasing the comprehension and retention of prose material.

Over a period of three years, Lesgold, Curtis, DeGood, Golinkoff, McCormick, and Shirmon (1974-1976) conducted numerous studies regarding the role of imagery in text comprehension. One of the major focuses of these studies was to determine if there is a developmental aspect in the utilization of mental imagery in facilitating comprehension and retention of prose material; that is, are there particular ages or perhaps stages when imagery mediation is more effective?

Lesgold and his associates conducted a series of five experiments to attempt to answer this question. Experiments One and Two were conducted with adults. Experiments Three and Four were conducted with third and fourth graders, and Experiment Five was conducted with first graders. The results indicated that a developmental trend did appear to exist. The findings indicated that six-year-olds were inhibited in their performance by the extra task demands. This was found to be true even in light of the fact that these children listened to, rather than read, the passage. Nine-year-olds were able to benefit only after specific and extensive training. Adult subjects benefited from imagery spontaneously.

An important distinction needs to be made concerning Lesgold's definition of comprehension. While some researchers may separate comprehension and retention into two different tasks, Lesgold does not; in all of these studies, he equates the two processes. By definition, all of the tasks required by the subjects in this study were in fact retention rather than comprehension tasks. This approach to measuring comprehension was, in fact, used by all of the researchers discussed in this section on imagery in prose learning.

A recent investigation by Linden and Wittrock (1981) utilized Wittrock's model of generative learning in which readers build relationships between their knowledge and the text, as well as among the different parts of the text. Part of this model indicates that comprehension is facilitated by inducing readers to attend to the text through imagery. This experiment, conducted with ten-year-olds, included conditions that closely approximated a classroom setting, and it was conducted over several days. Using a unifactor, four-treatment design, 64 fifth grade children were randomly assigned to one of four treatment groups: (1) marginal to verbal generations, (2) verbal to marginal generations, (3) no instructions to generate, and (4) classroom teacher taught control group. Results indicated that the two groups that used the generative procedure had enhanced comprehension. It did not matter whether the student was in the imaginal to verbal group or the verbal to imaginal group. Both produced approximately the same number of generations and a comparison of their comprehension scores showed no significant differences.

With the exception of the research by Lesgold and his associates (1974-1976), the previously cited research was undertaken with children. It is, therefore, of interest to investigate what the literature contains concerning mental imagery and comprehension of text material with older individuals. Does the available literature support Lesgold's findings that imaging is a viable mediation technique for adults? Does the literature support his conclusion that adults benefit spontaneously from the utilization of mental imagery?

Research Undertaken with Adults

Anderson and Kulhavy (1972) conducted an experiment with 62 high school seniors using a 2,190 word content area passage. The experimental group was instructed to form vivid mental images of everything described in the passage while the control group was instructed to simply read the passage carefully. Upon completion of the reading, each student answered 34 short-answer items and 34 multiple-choice questions with stems in one-to-one correspondence to the short-answer questions. The subjects were also given a nine-item questionnaire which inquired about the study strategy used, carefulness in reading, and interest in the materials. Analysis of variance failed to show a significant effect for instruction, test mode, or the interaction of these factors. Analysis of the questionnaire, however, offered explanations of these results. More than half of the control group reported using imagery while studying the passage while about one-third of the experimental group reported that they did not use imagery elaboration. Anderson and Kulhavy then utilized an unweighted means analysis of variance which indicated that performance was related to imaging reports. These findings are consistent with those of the Lesgold et al. studies (1974-1976) in that older individuals may, in fact, spontaneously use imagery to better comprehend and retain prose material. The point should also be made that this study also employed a recall task in that the subjects did not have access to the passage while answering the questions.

Two experiments conducted by Steingart and Glock (1979) explored the effects of imagery and text organization of prose material. In the first experiment 66 college students read nine reading passages each containing 19 sentences. Three different topics and three different sentence organizers were used. The subjects were given one minute and thirty seconds to read each passage and were allowed five minutes to answer 16 multiple-choice questions. A 2 x 3 x 4 design collapsed for analysis showed significant results.

Experiment Two employed essentially the same procedures except that the subjects were told to write down all they could remember about the passage (free-recall). Upon completion of the reading, the question-level factor was removed, a cueing factor was added, and the subjects were tested on both immediate and delayed recall. Imagery was found to be facilitative regardless of the text organization.

From the results of the two experiments Steingart and Glock drew the following conclusions. First, subjects who used imagery were able to draw more inferences than the subjects who were instructed to use repetition strategies. The researchers interpret this as an indication that one of the functions of imagery with concrete prose is the formation of unitized non-verbal mnemonic representations. Second, it was felt that imagery encouraged a reorganization of textual material, and that this is the way the material is stored in the memory.

Montague and Carter (1973) paralleled imagery research in paired-associate learning and sentence learning by investigating how the vividness of passages affects the use of imagery. Hypothesizing that more vivid passages would be more appropriate for the use of mental imagery, they taught 44 subjects one of two versions of four paragraphs that were constructed with different degrees of vividness. After reading the paragraphs, the subjects were given a four-minute free recall period. Using analysis of variance, it was found that instructions to use imagery produced no significant differences, but the image-evoking value (vividness) produced significant differences in the recall of substance words, but not for the function words. An interaction was observed between the instructions and vividness.

The conclusions of Montague and Carter suggest that syntactic organization has a large effect on recall. They explained the lack of any effect due to instructions in much the same way as Lesgold and his associates (1974-1976); that older individuals tend to use imagery spontaneously. In addition, the results concur with Paivio's (1969) findings that for concrete learning materials, subjects automatically use imaging techniques.

A study by Irwin and Witte (1980) conducted two investigations concerning relationships between the number and clarity of mental images reported by college students on either abstract or concrete expository materials and (1) their comprehension scores, (2) their self-rated reading ease, and (3) their interest ratings.

In the first investigation 102 college students were randomly assigned to one of two abstract or one of two concrete passage conditions. Significant differences were found in terms of both the reported number of images and the clarity of images. The second investigation, however, produced no replication of these results. Irwin and Witte stated that the conflicting results were due to the fact that the readability was controlled for in the second investigation. In addition, no correlations were found between the number and clarity of images reported and the comprehension scores. This result is in conflict with other researchers (Levin, 1973; Lesgold et al., 1974-1976; Steingart and Glock, 1979) but somewhat consistent with the results of Montague and Carter (1973). Irwin and Witte explain these results by suggesting that college students have a wider variety of reading strategies at their disposal. It should also be pointed out that the subjects involved in both of these studies were upper-level undergraduate or graduate level psychology students. Perhaps a more plausible explanation would be that good readers, not necessarily college students in general, possess a wider variety of reading strategies. Research by Levin (1973) and Waller (1976) indicated that perhaps poor readers are more prone to the use of imaging techniques. Additionally, the authors have the students answer only five questions and it is never made clear whether the actual task at hand is one of comprehension or recall.

Conclusions

There are several problems that emerge when surveying the research conducted with imagery and its relationship to prose learning. First, it appears that researchers are confusing the terms "comprehension" and "retention." A true comprehension task is one in which the subject has access to the passage while a retention or recall task does not permit such access. None of the studies cited were actually testing comprehension although researchers often claimed that they were. In all cases either immediate or delayed recall or recognition was being tested. In a large sense, therefore, these studies are telling nothing about the effects of mental imagery on reading comprehension.

Second, while it is an accepted fact that the vocabulary level of a passage is a major factor in the amount comprehended (Carroll, 1977), none of the studies even mentioned its importance. How can a student who does not know the meaning of a word image it?

Third, the importance of vocabulary is closely tied to the world knowledge or perceptual background of the students. If the concepts presented in reading are at too high a level for an individual to grasp, imaging techniques or other learning strategies will probably not be successful. It, therefore, becomes important not only to teach imaging techniques, but also to control for the readability level of the passages.

When surveying the total imagery picture from paired-associate learning to prose comprehension, certain patterns do emerge in the research. At all levels of processing--word, sentence, prose--the concreteness or abstractness appears to affect the ability to form images. Perhaps, however, even more important is the vocabulary and world knowledge aspect that an individual brings to the learning situation. No matter how concrete a word, sentence or passage, imagery would be difficult if the student lacked the perceptual background to form the needed images.

Conflicting research exists on the developmental aspect of imagery. While some research indicates that older individuals spontaneously utilize mental imagery, other research indicates that this is not the case. [However, there appears to be an agreement concerning the importance of imagery training at all age levels; that is, the more comprehensive the training, the more effective the facilitation.]

While there is no empirical research to confirm or deny the relationship between the effectiveness of imagery with good and poor readers, the available literature does suggest that poor readers tend to utilize more imagery than good readers. This is due to the fact that good readers possess a variety of reading strategies which they engage in at appropriate times while poor readers do not.

Much of the research is either inconclusive or conflicting, especially research using prose material. Many questions remain unanswered. It is, therefore, important for more empirical research to be carried out by qualified persons who are well-versed in the problems and processes of reading and who can make practical applications of the findings to the classroom setting.

Chapter III presents the development of the instruments and the methodology used in this study. These instruments and procedures were used to determine the effects that induced mental imagery has on the comprehension and retention of content area material for high risk college students.

CHAPTER III
INSTRUMENT DEVELOPMENT AND METHODOLOGY

The implications of the results of this study depend heavily on the instruments used; therefore, pilot work conducted in the development of the instrumentation is described in this chapter in considerable detail. Also included are a description of the sample, the instructional procedures followed, and the method of data collection.

Development of the Instruments

Major Testing Device--The Imagery Content Area Tests (ICAT)

The purpose of this study was not only to determine if imaging is a viable technique for increasing the comprehension and retention of high risk students, but also to determine if imagery is more appropriate for use in a particular content area. Consequently, it was important that the three passages used to test the hypotheses be equal in length, readability, and imaging value. Research undertaken by Paivio (e.g., 1969) has shown that material higher in imaging value is more easily retained. Therefore, if the passages differed significantly in imaging value, no causal inferences could be made concerning the use of imagery across different content areas since imaging value would confound with content area.

In addition, the comprehension questions needed to be tested for reliability and equal difficulty. If the comprehension test which accompanied each of the passages had a low reliability it would not be known if all of the items were measuring the same thing (internal consistency). The mean number of items correct for each passage also needed to be equivalent.

In order to validate this instrumentation a pilot study was undertaken during the summer of 1981. The subjects were 114 students enrolled in several sections of a developmental reading course. Participants were first or second semester freshmen who were special admissions and, thus, high risk students who were enrolled in the Special Services Program at the University of Florida.

Over a period of three consecutive weeks, subjects read three content area passages, one each week, in the following order: "Smoking" by Marshall Smith, a biological science selection (Passage A); "Immortality Syndrome" by James Gollin, a social science selection (Passage B); "Filboid Studge, the Story of a Mouse that Helped" by H. H. Munro, a literature selection (Passage C). Passages from these particular content areas were chosen because college students are expected to take courses from these disciplines. These passages exemplified the required reading materials for which a majority of lower division students were enrolled. Additionally, the length of each passage was reduced from approximately 1,500 words to approximately 1,000 words. Information judged as unimportant for the understanding of the passage was deleted or condensed.

After the subjects read each passage with no time limits imposed, they answered 20 multiple-choice comprehension questions which were constructed by the researcher. Half of the items were classified as literal questions and half were identified as inferential questions.

All subjects were then instructed to complete the Voss-Newell Imagery Rating Scale (V-NIRS) for each passage. The subjects were told to circle one number for each pair of adjectives. They were also informed that there were no right or wrong answers; responses were general impressions of the passage and were not related in any way to intelligence.

The V-NIRS was chosen for use in rating the imagery value of the passages selected for the ICAT for three reasons. First, this scale was developed for rating prose passages along three dimensions of imagery: abstraction, generality, and inclusiveness. The basic framework of the scale was taken from the work of Paivio and his associates (1968). Second, research has been conducted on the reliability of the scale. Newell and Olejnik (1980) conducted a principal components factor analysis on this seven-point semantic differential scale to evaluate the ratings of different prose passages which they selected. These passages were rated by three independent samples of raters. Each of the three solutions resulted in the identification of three significant factors. Third, no other data-based instrument could be found that rated the imaging value of prose materials.

A random selection of the responses on the comprehension questions and imagery ratings for half of the subjects (n = 57) was used in the preliminary item analysis while the responses of the other half of the sample were used for cross validation purposes.

Results of the preliminary investigation presented in Table 3-1 indicate that passage length was essentially the same and little variation existed in the readabilities as measured by the Fry Readability Formula. However, a one-way analysis of variance conducted on the imagery value data of the passages indicated significant differences between passages, $\underline{F}$ (2,56) = 8.29, $\underline{p}$ = .005.

Table 3-1
Length, Readability, and Mean Imaging Values of the Original Three Content Area Passages

Passage	Length	Readability	Mean Imaging Value
A	1,040 words	low 10th	92.93
B	1,090 words	low 10th	86.17
C	1,050 words	high 9th	80.93

Note: Passage A is "Smoking" by Marshall Smith
Passage B is "Immortality Syndrome" by James Gollin
Passage C is "Filboid Studge, the Story of a Mouse that Helped" by H. H. Munro

Table 3-2 indicates the results of the follow-up comparisons. No significant differences were revealed between Passage B and Passage C but significant differences were found between Passage A and Passage B as well as between Passage A and Passage C. Since including Passage A with its significantly higher imagery rating value would have confounded the results of the study, another biological science passage was chosen and piloted to ensure equivalency on length, readability, and imaging value.

Table 3-2
Follow-Up Comparisons on Imagery Value Between the Original Three Content Area Passages

Contrast	t-value	$p > t^a$
A vs B	2.29	.0245
B vs C	1.77	.0801
A vs C	4.06	.0001

[a] Tested at the .05 level of significance

The new scientific passage, "The Long, Cold Sleep" by Harold Schmeck was selected because it approximated the length and readability of Passages B and C and because it appeared to have a similar imaging value as measured by the V-NIRS.

The validation of the new selection followed the same procedures as those followed for the other two passages, but it was tested on a smaller sample size (n = 42). The subjects read the passage and then answered a series of 20 comprehension questions which had been constructed by the researcher. Then they completed the V-NIRS. The subjects involved in the validation of this passage were also classified as high risk students so that the same type of population was used to validate all three passages.

The data obtained from the imagery rating scale on the two original passages and the new biological science passage were analyzed using a one-way analysis of variance and all possible pairwise comparisons were made. The mean imaging value of the new passage was 85.77. Table 3-3, which indicates the results of the three comparisons, shows that the passages did not differ significantly on imaging value, $\underline{F}$ (2,89) = 2.14, $\underline{p}$ = .1241.

Table 3-3
Follow-Up Comparisons on Imagery Value Between the Final Three Content Area Passages

Contrast	t-value	$p > t^a$
A vs B	-0.14	.887
B vs C	1.86	.067
A vs C	1.72	.090

[a] Tested at the .05 level of significance

Initially, it was decided to eliminate from each passage the five comprehension test items with the lowest point biserial values. However, upon cross validation using only 15 items, reliability of the test was reduced considerably since the test length had actually been reduced by one-fourth. As a result, only items with a $r_{pbis} < .20$ were deleted from each set of 20 questions, leaving 18 items on each passage for testing comprehension. The item analysis procedure was carried out using a packaged program from Statistical Analysis System (SAS).

A summary of the final reliabilities, means, and variances for the comprehension test items, as well as the mean imagery ratings for each passage, is presented in Table 3-4. Since the means of the comprehension scores differed by less than two items it was felt that carrying out an analysis of variance to test for equivalency of the scores was unnecessary. Point biserial values for each of the remaining 18 items for all passages are presented in Appendix B.

Table 3-4
Final Validation Statistics for the Comprehension Test Items and Imagery Ratings for the Three Content Area Passages

Passage	KR-20	Mean	Variance	Mean Imagery Ratings
A	.74	11.0	12.41	85.77
B	.70	10.91	10.92	86.17
C	.71	9.85	10.94	80.93

Note: This final validation was based on 18 test items.

When interpreting the results of the pilot data, several factors need to be kept in mind. While this pilot was conducted on an adequate sample size (n = 57) and cross validated on the same number, the participants were all high risk college students. This homogeneous selection was appropriate since the actual study was conducted using this type of population. However, the fact that the validation was conducted with high risk college students is, in itself, a problem. It is difficult to write discriminating items for a group such as this. Their performance on comprehension tasks tends to be erratic due to a number of factors. First, reading performance is highly dependent on the vocabulary in the passage (Carroll, 1977). No actual instruction was given on vocabulary prior to the testing procedure; subjects were merely asked to read the passage and then to answer the questions. Second, the majority of high risk students have poor experiential backgrounds. Therefore, some of the vocabulary and concepts in the passages may have been difficult for students to understand without teacher-directed instruction. This might be true even though attempts were made to control for readability levels of the passages. Finally, many of these students have low levels of motivation which could have caused one of two things to occur; either the student did not read the passage in the first place and then randomly guessed on the majority of test items, or the student guessed at answers to questions she/he was not sure of rather than referring to the passage.

In conclusion, the three passages selected for the ICAT proved to be of approximately equal length and readability and showed no significant differences in imaging value as measured by the V-NIRS. The comprehension test items for the passages possessed almost equal reliability coefficients. It was concluded, therefore, that the instrument was appropriate for use in this investigation.

Vocabulary Pretests and Posttests

Since vocabulary plays a major role in the comprehension of content area material (Carroll, 1977), a passage-specific vocabulary pretest was developed for each selection (see Appendix A). This pretest was constructed to be given prior to teaching the lessons and to indicate students' needs for vocabulary instruction. Words chosen for the pretest were checked for content validity by 11 students enrolled in the doctoral program in reading at the University of Florida. Difficult words that were identified by 50 percent of the doctoral students were included on the pretest.

The instructions directed the subjects to read the stem containing an underlined word in context, to read the four foils, and then to choose the synonym that most closely approximated the underlined stimulus word.

The vocabulary posttest was constructed consisting of the identical words used on the pretest. The only difference was that the ordering of both the words and the foils was changed.

Imagery Questionnaire

The final instrument prepared for the study was an imagery questionnaire to be given to all groups upon completion of the study (see Appendix A). The purpose of this questionnaire was to determine not only if Group 1 (those trained in imaging techniques) actually used them, but also to determine if those in Groups 2 and 3 (the two control groups) spontaneously imaged without having had instruction in imaging techniques. Subjects were also asked to indicate what additional strategies, if any, they thought enabled them to comprehend and/or retain the selections.

Procedures for the Study

Instructional procedures and the collection of the data for this study were carried out over a consecutive six-week period beginning in early March 1982 and ending in mid-April 1982.

Description of the Sample

The sample was drawn from students voluntarily enrolled in REA 1105, a developmental reading course offered at Central Florida Community College in Ocala, Florida. Students enrolled in this course were classified as high risk because they received scores below the 35 percentile on the Nelson-Denny Reading Test. Students were, therefore, strongly encouraged to take the reading course and were told that without it they would probably have problems handling college level text material.

Because there were limitations on scheduling, random assignment by individuals was not possible. Rather, classes of students were randomly assigned by sections to one of the following three conditions: imagery, directed reading activity, or no instruction. In order to test for equivalency of the groups, the comprehension raw score on the Nelson-Denny Reading Test was used. It was also used as a covariate to eliminate variation due to reading comprehension ability. The N-DRT is a standardized reading survey test which yields a vocabulary score, a comprehension score, and a reading rate. This test is widely used for both screening and global diagnosis in reading courses at the college level. The split-half reliability of the N-DRT is .83, while predictive validity coefficients range from .10 to .70 with a median of .40 (Brown, et al., p. 14). Recent scores on the N-DRT were available from the students' records and, therefore, it was not necessary to readminister the test.

The original sample size consisted of 48 subjects; however, data on only 41 subjects were used in the final data analysis. One subject in the imagery group missed several classes, two subjects in the DRA group chose not to participate, two subjects in the DRA had missing data, and two subjects in the no instruction group failed to attend all class sessions. A total of 41 subjects--14 in the imagery group, 13 in the DRA group, and 14 in the no instruction group--had complete data which were analyzed in this study.

Table 3-5 summarizes the schedule followed in carrying out this study.

Table 3-5
Schedule of Procedures Followed in the Study

Week	Tuesday	Thursday
1	Group 1: Imagery training	Group 1: Imagery training
2	Teach Passage A to all groups and test for comprehension	*
3	Test retention of Passage A to all groups	Teach Passage B to all groups and test for comprehension
4	*	Test retention of Passage B to all groups
5	Teach Passage C to all groups and test for comprehension	*
6	Retention--Passage C to all groups Administer imagery questionnaire to all groups	

*Indicates that nothing pertaining to the study was occurring on that particular day.

Instruction and Data Collection

Imagery group

Since research indicates that the induced imagery strategy tends to be more effective with older individuals than does the imposed imagery strategy (e.g., Levin, 1972), the induced imagery strategy was used in this study. A body of research (e.g., Levin, 1973; Kulhavy and Swenson, 1975; and Pressley, 1976) also indicates that those trained in induced imagery tend to comprehend and retain significantly more than those who are directed only to read a passage and then to answer a series of comprehension questions.

During the first week of the study on Tuesday and Thursday, subjects in the imagery group (Group 1) were trained in imaging techniques. The researcher met with the imagery group for two training sessions, each session lasting one hour. Training in induced imagery took the following steps:

1. The researcher began by defining imagery as the innate ability of the mind to form patterns, mental structures of concepts, objects, processes, events, and relationships which result from perceptions of the world. This definition was explained in lay terms, and any misconceptions were clarified. The investigator then asked the subjects to image the word "dog" and to describe their image. The word "dog" was chosen because it is a concrete word and possesses a high imagery rating. It was stressed that images need not make sense to anyone else except the one imaging. The following additional words were given, each with decreasing imaging value: "chair," "dawn," "love," "kindness," "democracy." The same procedure was followed throughout the course of the study except that the words given were in some way related to the

passage being read. This exercise was referred to as "warm-up."

2. After "warm-up," the Breakfast Table Technique--a procedure developed and named by Galton (1883)--was taught. Students were asked to image and then to describe orally settings or objects familiar to them. Such suggested settings included the students' breakfast tables, their dorm rooms, their bedrooms at home, and/or the streets where they live. Students were encouraged to use as vivid descriptions as possible. Leading questions were asked by the researcher to ensure as much detail as possible at this stage. This procedure was used to make the participants aware of what induced mental imagery is and to make them aware that they can remember objects they have seen or experiences they have had when they actively engage in this technique.

3. With explicit instructions from the researcher, the subjects in the mental imagery group were trained to engage in imaging techniques using three different passages of increasing length (see Appendix A). The first passage chosen for imagery instruction was on human intelligence and was approximately 250 words. It was chosen because it was a short selection and easy to image since it contained many concrete nouns. With the first introductory passage participants read the selection one paragraph at a time. After a paragraph was read, descriptions of mental images were verbalized and discussed. Again, the personalization of images was discussed.

4. As consecutive paragraphs were read, instructions were given on building-on to the previous image rather than on forming a completely new image. For example, after the first introductory passage was read, one of the subjects said that he imaged a mansion with the house number 125 on it to remember the one twin placed in the wealthy home, and he imaged a shack with the house number 80 on it to remember the other twin

placed with the poorer family. While some subjects appeared to image more vividly than others, no one had problems in describing what they imaged.

5. Upon completion of the first introductory passage, subjects were given three multiple-choice questions and were instructed to write out brief descriptions or to draw pictures of the images formed to answer each question.

6. The second passage was then read. It was 350 words long and contained information on animal intelligence. Five comprehension questions were written for this passage. The final training passage was the longest and contained 480 words. It was a literature passage that could generate a variety and wealth of images. Five comprehension questions also accompanied this selection. As students moved from one passage to the next, they were encouraged to extend the amount read while forming interactive images to aid in their comprehension. Subjects then were directed to follow the same procedures used in Steps 4 and 5.

7. Those who indicated difficulty in forming mental images were given suggestions by the researcher for possibly improving on their image formations and then were asked to form and describe verbally their own images.

After the subjects in Group 1 completed the instructions for using imaging techniques, the first week of data collection began. Students were given the vocabulary pretest for Passage A, "The Long, Cold Sleep." Vocabulary instruction in which subjects were encouraged to formulate images to aid in remembering word meanings followed. Then subjects were reminded to form images as they read the content area passage and as they answered the 18-item comprehension test. In addition, subjects were encouraged to answer the questions without referring to the selection, but they were told that they could refer to the passage if needed for clarification and verification.

One week later, subjects were given the four "warm-up" words used in the comprehension activity for Passage A. This was done to stimulate recall. They they were re-tested on the passage to determine how much information they had retained from the initial reading and were given the vocabulary posttest. In the ensuing weeks at one-week intervals, data were collected for each of the two remaining selections in the same manner as for Passage A. The only difference was that different "warm-up" words were used with each selection (see Appendix C).

Directed reading activity group

For each of the three passages on the ICAT, Group 2 received instruction using a traditional directed reading approach. Specific materials used for each passage are included in Appendix C. The general procedure for instruction included the following steps:

1. Vocabulary pretest. The subjects were given a passage specific vocabulary pretest for each of the three selections. This pretest was given prior to the introduction of each passage to identify students' needs for vocabulary instruction.

2. Motivation and background. At this stage in the directed reading activity subjects were given conceptual background information which would aid in their understanding of each passage. Probing questions were asked so that subjects could relate past perceptual experiences to what was going to be read.

3. Vocabulary development. The passage specific vocabulary words were taught in context. Subjects received both oral and visual exposure

to each word. Each word was used in a sentence by the instructor and then was also used in a different sentence by one of the subjects in the group.

4. Purpose setting. Subjects were given specific purposes for reading each passage. They were also encouraged to develop their own purposes based on the information provided in Step 2.

5. Silent reading. Each subject read the entire passage silently.

6. Comprehension questions. Subjects were instructed to answer 18 multiple-choice questions relating to the passage. Access to the passage was permitted and students were encouraged to refer to it for verification or clarification.

One week following the initial reading of each passage, Group 2 was also given the 18-item multiple-choice retention test and the vocabulary posttest.

No instruction group

Group 3 received no instruction. They were given the vocabulary pretest and then received a vocabulary list which defined each of the words. This list was received along with the reading passage, and subjects were informed that the list might aid them when reading the selection. Prior to reading the passage, subjects were told to read the passage carefully after which they would be given a comprehension test on their reading. As with Group 1 and Group 2, Group 3 also was permitted access to the passage if needed when answering the comprehension questions. Additionally, one week later they were also given the retention test for each passage as well as the vocabulary posttest.

Treatment of the Data

The major purpose of this study was to investigate the use of imagery as a means of increasing the comprehension and retention of content materials. An additional purpose was to determine if subjects benefited by using imaging techniques in one content area over another. Seven general hypotheses were tested in the investigation.

The comprehension data and the retention data were analyzed using a two trial, one grouping factor (group x passage x test), split-plot repeated measures with one covariate consistent across all repeated measures design. This design, depicted in Figure 3-1, indicates that subjects in s_1 receive only one level of treatment A but all levels of treatment B. Each level of B passage type contains two factors: comprehension (c) and retention (r). The analysis of treatments A and B in a split-plot design, when viewed separately, resembles the analysis for a completely randomized design and a randomized block design respectively (Kirk, 1968, p. 246).

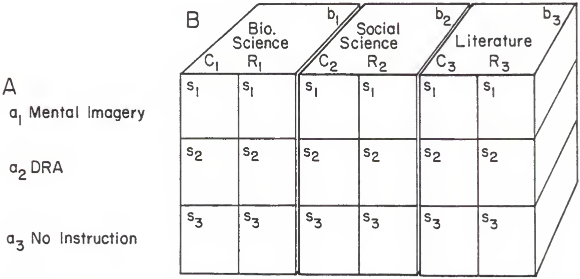

Figure 3-1. Graphic depiction of the split-plot repeated measures design.

Split-plot designs in which a subject receives all levels of some treatments but only one level of other treatments are often referred to as mixed designs. The grouping and trial factors are all fixed effects factors. A factor for subject, although not explicitly defined, is the only random effects factor. Each subject is observed at all combinations of the trial factors, but at only one level of each grouping factor (Jennrich and Sampson, p. 540).

The comprehension subtest of the Nelson-Denny Reading Test was used as a covariate for each of the repeated measures. This analysis was used to eliminate variation due to reading comprehension at least as measured by this particular test. The use of analysis of covariance reduces the error variance and therefore makes the analysis more powerful.

The Biomedical Computer Programs was used for the statistical analysis. Simple effects and follow-up planned comparisons were calculated when appropriate.

The results of the imagery questionnaire were analyzed through two programs from SAS. The first program provided a frequency of responses in percentages to the items across all groups. The second procedure, a chi square test for significance, was run on each question for each group to determine statistically significant differences in responses according to group membership.

Chapter IV presents the results of these analyses and separately addresses whether or not each of the hypotheses tested in this study was rejected.

CHAPTER IV
ANALYSIS OF THE DATA

This study was concerned with two major questions. First, would high risk students who had been trained in induced mental imagery techniques perform significantly better on comprehension and retention activities than those students who were instructed with a directed reading approach or who received no instruction? Second, is one content area--biological science, social science, or literature--more appropriate for the application of imaging techniques than another?

In order to answer these questions 41 high risk college students were randomly assigned by groups to one of three conditions: imagery, directed reading approach, or no instruction. Over a five-week period, each subject read three content area selections and answered a series of 18 multiple-choice comprehension questions. One week following the reading of each passage, subjects took an 18-item multiple-choice retention test. Seven hypotheses were tested using split-plot repeated measures design with analysis of covariance. The results of the statistical analyses are presented in this chapter.

Findings Related to the Hypotheses

Statistical analyses were carried out using the BMDP packaged program for a two-trial factor, one-grouping factor, with one covariate consistent across all repeated measures. The raw score on the comprehension subtest of the Nelson-Denny Reading Test was used as the covariate. The means and (variances) on the N-DRT for the three groups were as follows: Group 1, 28.57 (8.50); Group 2, 29.23 (10.15); and Group 3, 26.28 (12.28). An analysis of variance test for the difference between these means was not significant, F (2.43) = .53, p = .5903. The covariate, however, was shown to be a significant predictor of the dependent variable, F (1,37) = 27.31, p = .000.

The following major hypotheses, stated in the null form, were tested at the .05 level of significance:

> Hypothesis I: After eliminating variation associated with reading comprehension as measured by the comprehension score on the Nelson-Denny Reading Test, there is no significant interaction between the type of passage (biological science, social science, or literature), the type of test (comprehension or retention), and group membership (imagery, directed reading activity, or no instruction).

The adjusted cell means and standard deviations for the comprehension and retention scores for all groups and all passages are presented in Table 4-1. Table 4-2 summarizes the results of the statistical analyses for the design. The F statistic for the passage (P) by test (T) by group (G) interaction (P x T x G) was found to be nonsignificant, F (4,76) = 1.35, p = .2609. Therefore, the null hypothesis was not rejected and it was concluded that after covarying on reading comprehension, there was insufficient evidence to suggest that the simple interaction effects of the two variables changed as a function of the level of a third.

Table 4-1
Adjusted Cell Means and Standard Deviations for Dependent Variables

Group	Passage A C	Passage A R	Passage B C	Passage B R	Passage C C	Passage C R
1	12.27 (1.86)	10.98 (1.27)	11.41 (2.41)	11.13 (2.39)	11.98 (1.27)	11.06 (1.79)
2	11.12 (2.81)	9.66 (2.48)	7.96 (2.19)	6.66 (2.48)	11.04 (2.89)	9.04 (2.83)
3	10.83 (4.27)	10.05 (4.32)	10.55 (3.73)	8.76 (4.23)	10.76 (3.23)	9.62 (3.43)

Table 4-2
Summary Table for the Two-Factor Split-Plot Repeated Measures with One Covariate Design

Source	Sums of Squares	Degrees of Freedom	Mean Square	F
Group (G)	205.30625	2	102.65313	4.79**
Covariate	585.54660	1	585.54660	27.31*
Passage (P)	93.02271	2	46.51136	9.02*
Test (T)	91.48354	1	91.48354	51.54*
P x G	71.00482	4	17.75121	3.44**
T x G	5.80789	2	2.90395	1.64
P x T	.60128	2	.30064	.19
P x T x G	8.36371	4	2.09093	1.35

* < .01 level of significance

** < .05 level of significance

> Hypothesis II: After eliminating variation associated with reading comprehension as measured by the comprehension score on the Nelson-Denny Reading Test, there is no significant interaction between the type of passage and the type of test.

The adjusted means for comprehension and retention across all groups for the six combinations of passages and tests are presented in Table 4-3. Figure 4-1 presents a plot of the data and serves to pictorially clarify the relationship between passages and scores for each type of test. The statistical test for the interaction between the type of passage and type of test (P x T) was not significant, $F\ (2,76) = .19$, $p = .8245$. Hypothesis II, therefore, was not rejected and it was concluded that after eliminating variation associated with reading comprehension, the difference between comprehension scores and retention scores was the same for all three passages.

> Hypothesis III: After eliminating variation associated with reading comprehension as measured by the comprehension score on the Nelson-Denny Reading Test, there is no significant interaction between the type of test and group membership.

Table 4-4 presents the adjusted cell means across all passages for both comprehension and retention. Figure 4-2 displays the plot summarizing the relationship between comprehension and retention for each group. The statistical analysis indicated that there was no significant interaction between test and group membership, $F\ (2,38) = 1.64$, $p = .2081$. Therefore, it was concluded that the difference between the magnitude of the groups on comprehension is the same as the difference on retention.

Table 4-3
Adjusted Cell Means for Comprehension and Retention Data Across all Groups

	Passage A	Passage B	Passage C
Comprehension	11.04	9.97	11.26
Retention	10.23	8.85	9.96

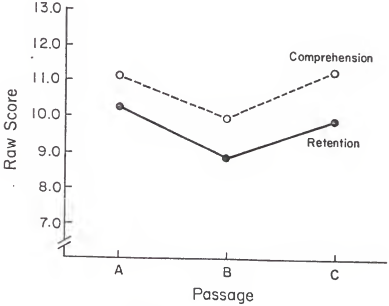

Figure 4-1. Plot indicating lack of interaction between passage and test.

Table 4-4
Adjusted Cell Means by Group for Comprehension and Retention Data Across all Passages

Group	Pass A, B, & C Comprehension	Pass A, B, & C Retention	Difference
1	11.89	11.07	.82
2	10.04	8.45	1.59
3	10.71	9.48	1.23

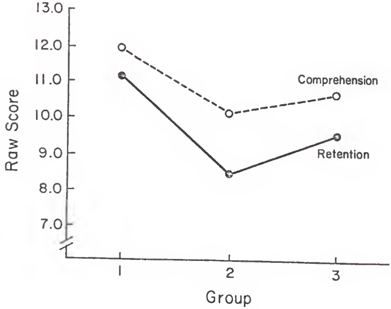

Figure 4-2. Plot indicating lack of interaction between test and group membership.

> Hypothesis IV: After eliminating variation associated with reading comprehension as measured by the comprehension score on the Nelson-Denny Reading Test, there are no significant differences between the scores on the comprehension test and the scores on the retention test.

The mean for comprehension across all groups and all passages was 10.88, while the mean for retention was 9.66. The main effect for test was significant, F (1,38) = 51.54, p = .000. Hypothesis IV, therefore, was rejected and it was concluded that across all groups and all passages comprehension scores were significantly higher than retention scores.

Prior to the discussion of the remaining hypotheses, the decision not to reject the three way interaction (P x T x G) deserves elaboration. Since Hypothesis I was not rejected nor was the two way interaction for test by group (T x G) and the two way interaction for test by passage (T x P), comprehension and retention data were combined across passages for statistical analysis. That is, whatever can be said about comprehension can also be said about retention. Therefore, since it would be redundant to discuss comprehension and retention separately due to the results of this analysis, the two have been combined for a more succinct discussion in the remainder of this chapter.

> Hypothesis V: After eliminating variation associated with reading comprehension as measured by the comprehension score on the Nelson-Denny Reading Test, there is no significant interaction between the type of passage and group membership.

Table 4-5 indicates the combined adjusted means for each passage according to group membership, while Figure 4-3 plots the cell means and

Table 4-5
Adjusted Means Combined for Analysis for
All Passages and All Groups

Group	Passage A	Passage B	Passage C
1	11.62	11.27	11.52
2	10.39	7.31	10.04
3	10.44	9.66	10.19

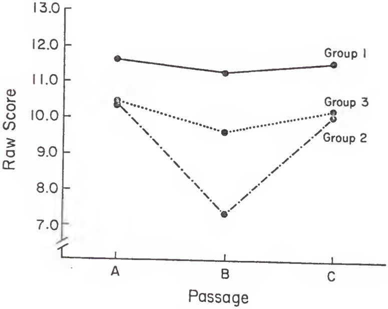

Figure 4-3. Plot of cell means summarizing the relationship between passages and scores for each group.

summarizes the relationship between passages and scores for each group. The test for the interaction (P x G) was significant, F (4,76) = 3.44, p = .0122. Hypothesis V was rejected and it was concluded that the difference between the combined comprehension and retention scores on the three passages was not the same for the three groups. While Group 1 was consistent in combined scores on all three passages, Groups 2 and 3 were not. Group 2 scored especially low on Passage B while scores for subjects in Group 3 also declined but not as drastically. Further tests of statistical significance are discussed under Hypothesis VII.

> Hypothesis VI: After eliminating variation associated with reading comprehension as measured by the comprehension score on the Nelson-Denny Reading Test, there are no significant differences between combined comprehension and retention scores on the biological science passage, the social science passage, and the literature passage across all three groups.

The combined adjusted mean comprehension and retention scores for each passage across all groups were 10.82, 9.41, and 10.58 respectively. The test for statistical significance for the main effect for passage was found to be significant, F (2,76) = 9.02, p = .003, and Hypothesis VI was rejected. However, since an interaction between passage and group was found to be significant, a test for differences between passages across all groups was inappropriate. Consequently, simple effects which indicate differences on passages for each group were computed. Follow-up comparisons were calculated when appropriate.

> Hypothesis VIA: After eliminating variation associated with reading comprehension, as measured by the comprehension score on the Nelson-Denny Reading Test, there are no significant differences between the combined comprehension and retention scores on the biological science passage, the social science passage, and the literature passage for Group 1.

The means for Group 1 for Passages A, B, and C were 11.62, 11.27, and 11.52 respectively. The test for the simple effect for differences between passages for Group 1 was not significant, $F\ (2,76) = .18247$, $p = .8356$. It was concluded, therefore, that imagery was equally effective for all three types of passages, after covarying on the variation associated with reading comprehension.

> Hypothesis VIB: After eliminating variation associated with reading comprehension, as measured by the comprehension score on the Nelson-Denny Reading Test, there are no significant differences between the combined comprehension and retention scores on the biological science passage, the social science passage, and the literature passage for Group 2.

For Group 2 the means for the three passages were 10.39, 7.31, and 10.04 respectively. Figure 4-4 visually depicts the relationship between the passages for each group and serves to pictorially clarify where differences exist. The test for the simple effect for differences between the passages for Group 2 was significant, $F\ (2,76) = 14.330$, $p = .0005$. Hypothesis VIB was, therefore, rejected and it was concluded that after covarying on comprehension scores on the Nelson-Denny Reading

Test, subjects did significantly better on at least one of the three passages. Hence, follow-up comparisons using the LSD procedure with the error rate set at a .05 level of significance per comparison were conducted. The results of the follow-up comparisons, presented in Table 4-6, indicate that the subjects in the directed reading activity scored equally well on Passage A and Passage C. The contrast Passage A versus Passage B and the contrast Passage C versus Passage B do not contain zero and, therefore, both hypotheses were rejected. Additionally, the scores on Passage B were always lower than the scores on Passage A or C, thus indicating that subjects across all groups did poorer on Passage B than on Passages A and C.

> _Hypothesis VIC_: After eliminating variation associated with reading comprehension, as measured by the comprehension score on the Nelson-Denny Reading Test, there are no significant differences between the combined comprehension and retention scores on the biological science passage, the social science passage, and the literature passage for Group 3.

The combined mean scores on each passage for Group 3 were 10.44, 9.66, and 10.19 respectively. The test for the simple effect for the differences between the passages for Group 3 was not significant, $\underline{F}$ (2,76) = .8759, $\underline{p}$ = .4189. Hypothesis VIC was not rejected and it was concluded that after covarying on comprehension as measured by the comprehension score on the Nelson-Denny Reading Test, those who received no instruction scored equally well on all passages.

> _Hypothesis VII_: After eliminating variation associated with reading comprehension as measured by the comprehension score on the Nelson-Denny Reading Test,

Table 4-6
Comparisons of Three Passages for Group 2
Using the LSD Procedure

Comparison	Confidence Interval	Decision
Passage A vs Passage B	(4.86,1.3)	Reject H_0 A > B
Passage C vs Passage B	(4.51,.95)	Reject H_0 C > B
Passage A vs Passage C	(2.13,-1.43)	Do not reject H_0 A = C

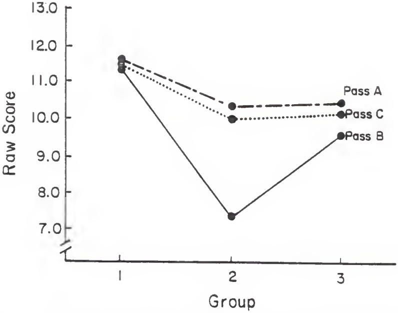

Figure 4-4. Plot of cell means summarizing the relationship between groups and scores for each passage.

> there are no significant differences between the combined comprehension and retention scores for Group 1, Group 2, or Group 3, across all passages.

Across all passages means for the three groups were 11.47, 9.24, and 10.09 respectively. The test for the main effect for group was found to be significant, $\underline{F}$ (2,37) = 4.79, $\underline{p}$ = .0141. Since an interaction between passage and group was also found to be significant, a test for differences between groups across all passages would be inappropriate. Consequently, the simple effects for the difference between groups for each passage are reported. Follow-up planned comparisons were made when appropriate. The nature of the relationship between groups and scores for each passage is clarified in Figure 4-3.

> Hypothesis VIIA: After eliminating variation associated with reading comprehension as measured by the comprehension score on the Nelson-Denny Reading Test, there are no significant differences between the combined comprehension and retention scores for Group 1, Group 2, or Group 3 on the biological science passage.

The means for Passage A for each group were 11.62, 10.39, and 10.44 respectively. The test for the simple effect for the difference between groups for Passage A was found to be nonsignificant, $\underline{F}$ (2,113) = 1.28, $\underline{p}$ = .2820. Hypothesis VIIA, therefore, was not rejected and it was concluded that across all groups there was not a statistically significant difference in the scores on Passage A.

> Hypothesis VIIB: After eliminating variation associated with the reading comprehension as measured by the comprehension score on the Nelson-Denny Reading Test, there

> are no significant differences between the combined comprehension and retention scores for Group 1, Group 2, or Group 3 on the social science passage.

The adjusted cell means for Passage B for each group were 11.27, 7.31, and 9.66 respectively. Figure 4-3 presents the relationship between groups and scores for each passage. The test for the simple effect for the differences between groups for Passage B was found to be significant, $F\ (2,113) = 10.026$, $p = .00098$. The hypothesis was rejected and it was concluded that after covarying on the comprehension score of the Nelson-Denny Reading Test, subjects in at least one of the groups scored significantly better than another group on this passage. Since the simple effect was significant, follow-up comparisons using the LSD procedure, with the level of significance set at .05, were carried out. Results of the comparison of the means, presented in Table 4-7, indicate that Group 1 and Group 3 scored significantly higher on Passage B than Group 2, but that Group 1 and Group 3 did equally well. The contrast Group 1 versus Group 2 and the contrast Group 2 versus Group 3 did not contain zero in the interval and, therefore, both hypotheses were rejected.

Table 4-7
Comparisons for the Three Groups on Passage B
Using the LSD Procedure

Comparison	Confidence Interval	Decision
Group 1 vs Group 2	(5.69,2.23)	Reject H_0 $1 > 2$
Group 1 vs Group 3	(3.30,-.08)	Do Not Reject H_0 $1 = 3$
Group 2 vs Group 3	(-.37,-4.33)	Reject H_0 $2 < 3$

Thus, for Passage B, both the imagery group and the no instruction group scored significantly higher than the group receiving the DRA. The mean score was higher for the imagery group than for the no instruction group, but not significantly so.

> Hypothesis VIIC: After eliminating variation associated with reading comprehension as measured by the comprehension score on the Nelson-Denny Reading Test, there are no significant differences between the combined comprehension and retention scores for Group 1, Group 2, or Group 3 on the literature passage.

The adjusted means for Passage C were 11.52, 10.04, and 10.19 respectively. The test for simple effects for the differences between groups for Passage C was not significant, F (2,113) = 1.712, p = .18551. It was concluded that the adjusted means across all three groups for Passage C were equivalent. Therefore, Hypothesis VIIC was not rejected.

Findings Related to the Imagery Questionnaire

In order to obtain descriptive data pertaining to self-report of the utilization of mental imagery and other learning strategies across all groups, an imagery questionnaire was distributed, explained, and then administered to all subjects (see Appendix A). The resulting data were analyzed using a packaged statistical procedure from SAS. Analyses indicated that 87 percent of all subjects formed images when reading, 100 percent reported the formation of imaging when answering the comprehension questions, while 97 percent reported use of imagery when answering the retention questions.

Subjects were then asked to rank order the passages according to the ease with which they were imaged, with "1" indicating the easiest to image and "3" indicating the most difficult to image. A "0" was to be used if all passages seemed equally imaginal. Responses to this question are presented in percentages in Table 4-8.

Item 5 on the questionnaire asked the subjects to rank the passages according to the ease with which they understood them. Directions for ranking were the same as for the previous question. The results, calculated in percentages, are shown in Table 4-9.

Table 4-8
Rank Order on Ease of Imaging for Each Passage

Rank	"The Long, Cold Sleep"	"Immortality Syndrome"	"Filboid Studge"
1st	45%	20%	32.5%
2nd	22.5%	50%	25%
3rd	30%	27.5%	40%
No Difference	2.5%	2.5%	2.5%

Table 4-9
Rank Order on Ease of Understanding for Each Passage

Rank	"The Long, Cold Sleep"	"Immortality Syndrome"	"Filboid Studge"
1st	37.5%	30%	30%
2nd	35%	45%	17%
3rd	25%	22.5%	50%
No Difference	2.5%	2.5%	2.5%

The final two questions attempted to determine what additional reported strategies subjects used when comprehending and retaining. Table 4-10 summarizes these results.

Table 4-10
Subject Responses Regarding Other Learning Strategies Used to Comprehend and Retain in Addition to Imagery

	*Comprehend	*Retain
Rereading	22.5%	N.A.
Summarizing	57.5%	N.A.
Paraphrasing	2.5%	5%
Overt Rehearsal	0%	52%
Covert Rehearsal	25%	0%
Used Imagery Only	17.5%	42.5%
Other	0%	7.5%

*Since subjects were asked to report all strategies used, some subjects reported more than one. This is why the total exceeds 100 percent.

In order to determine if groups behaved significantly different in their responses to the questions, a chi square test of statistical significance was carried out for each imagery questionnaire item. All hypotheses were tested at the .05 level of significance. Table 4-11 presents these results.

Responses to only two questions were found to be statistically significant. Question 6 required students to indicate strategies used in addition to or in place of imaging. One part of this question asked students to indicate if they said important material to themselves as an aid in comprehending (covert rehearsal). Responses were significant,

Table 4-11
Chi Square Test of Significance for
Each Item on the Questionnaire

	Question	χ^2	p	Decision
1	Imagery while reading	.414	.81	Do not reject
2	Imagery for comprehension questions	*	*	*
3	Imagery for retention questions	2.13	.34	Do not reject
4	Ease of imaging			
	a Long, Cold Sleep	8.59	.19	Do not reject
	b Filboid Studge	4.24	.64	Do not reject
	c Immortality Syndrome	7.38	.29	Do not reject
5	Ease of comprehending			
	a Filboid Studge	4.88	.56	Do not reject
	b Long, Cold Sleep	7.739	.25	Do not reject
	c Immortality Syndrome	7.552	.27	Do not reject
6	Strategies used during comprehension			
	a Rereading	1.05	.59	Do not reject
	b Summarizing	1.12	.56	Do not reject
	c Paraphrasing	1.19	.38	Do not reject
	d Other	**	**	**
	e Covert rehearsal	8.00	.019	Reject
	f Overt rehearsal	**	**	**
	g No other techniques	.23	.89	Do not reject
7	Strategies used during retention			
	a Paraphrasing	1.02	.60	Do not reject
	b Covert rehearsal	16.47	.0003	Reject
	c Overt rehearsal	**	**	**
	d No other techniques	5.34	.07	Do not reject
	e Other	2.22	.33	Do not reject

*All 41 subjects answered this question affirmatively.
**All 41 subjects answered this question negatively.

χ^2 (2) = 8.00, p = .0183. Table 4-12 indicates the differences between the groups in the way they answered this question.

Table 4-12
Chi Square Test of Significance for
Question 6e (Covert Rehearsal for Comprehension)

Group	No	Yes
1	53.85%	46.15%
2	69.23%	30.77%
3	100%	.00%

The other question which was statistically significant addressed strategies used to aid in the retention of the passages. Again, the only response which was significant was covert rehearsal, χ^2 (2) = 16.47, p = .0003. Table 4-13 indicates the differences between groups in the way students answered this question.

Table 4-13
Chi Square Test of Significance for
Question 7b (Covert Rehearsal for Retention)

Group	No	Yes
1	7.69%	92.31%
2	46.15%	53.85%
3	85.71%	14.29%

The results of the chi square test were not significant for any of the other questions indicating that responses were not dependent on group membership.

Discussion

Prior to a discussion of the specific results of the study, an explanation of the reasons for using a covariate with the repeated measures seems to deserve attention. Repeated measures designs are more powerful across the repeated measures than they are across group membership. On the other hand, analysis of covariance reduces the error term, thus making the analysis more sensitive to differences between the groups. A combination of analysis of covariance with repeated measures provides a more powerful analysis than just repeated measures alone.

For this investigation the data were analyzed first using analysis of variance with repeated measures and then with analysis of covariance. The use of a covariate made very little difference in the results. The only difference was that the main effect for group was significant when the covariate was used. The acceptance or rejection of all other hypotheses was the same for both statistical procedures. Justification for the use of the covariate was that it presented the most appropriate sensitive analysis.

Several findings surfaced as a result of this investigation. First, since the passage by test by group interaction, the passage by test interaction, and the group by test interaction all showed no significant results, comprehension data and retention data were combined for analysis. This lack of interactions indicates that whatever can be said about comprehension can also be said about retention. While a main effect for test was found, indicating that comprehension scores were significantly higher than retention scores, the patterns shown by the two types of tests were the same. This means that the difference between the average comprehension scores and retention scores across all passages and across all groups was consistent.

Along these same lines, the fact that the difference between comprehension and retention scores for the imagery group was only .82, less than one point, deserves comment. This suggests that subjects in the experimental group, on the average, retained almost as much as they comprehended initially. Individuals in the two control groups, however, averaged greater discrepancies between their comprehension and retention scores. Of interest also is that the discrepancy between the scores on the two types of tests was greater for the DRA group (1.59) than for the group receiving no instruction (1.23). This may suggest that when high risk college students are left on their own to read material rather than given direction on what to learn from reading, their performance may be somewhat enhanced but not statistically so.

Since an interaction between passage and group was significant simple effects and follow-up comparisons were computed. These results indicated that imagery was equally effective for the biological science passage, the social science passage, and the literature passage. But because of the interaction, it cannot be generalized that the imagery group had greater comprehension and retention than either the DRA group or the no instruction group, even though a main effect for group was present. The data do show, however, that the imagery group performed significantly better than the DRA group on Passage B.

The findings may not coincide with Paivio's (1969) concrete-abstract explanation of ease of imaging and understanding, especially when the materials read are from content areas. Paivio states that materials which are more concrete are more easily imaged and, therefore, more easily understood. Analyses of the passage imagery ratings may not bear this out. Initial ratings for the three passages on the Voss-Newell Imagery Rating Scale indicated that they were of equal imaging value. However, it was difficult to determine exactly how imaginal the selections were. It appears that they would fall within the average range (average scores were between 81 and 86 out of a possible 140 points), but it must be kept in mind that this is an average rating and that no normative data has been collected on the scale. Within the group of 114 subjects who rated the passages there existed a considerable range. Perhaps this indicates that an individual's ability to form images, as well as the type of images formed, is much more involved and personalized than the concrete-abstract explanation purported by Paivio (1969). Rather, these data suggest that past experience may have a larger role in determining the ease of imaging and ease of comprehension than does the concreteness or abstractness of a passage.

The passage by group interaction, and main effect for both passage and group should be interpreted with caution since these results could have several possible interpretations. The depressed scores for both control groups on Passage B are the crux of the problem. The average respective comprehension and retention scores for Passage B were as follows: Group 1, 11.41 and 11.13; Group 2, 7.96 and 6.66; and Group 3, 10.55 and 8.76. The average score on Passage B for the imagery group was about the same as the scores on Passages A and C while this was not true of the two control groups. In a sense this further complicates the issue. This researcher would like to state that these results indicate that the use of imaging techniques enhances comprehension and retention. To a certain extent, this is supported by the data due to the consistent performance of the imagery group across all passages. But it should also be pointed out that there may be problems inherent either in the passage or the instruction received by the directed reading activity group. The investigator taped all three directed reading activities and upon playing the tape for Passage B, could find nothing that would explain the considerable decrease in scores on this passage when compared to other passages. Perhaps the conceptual level was too high, although the readability of this passage was the same as the other two passages. Additionally, this fails to explain why the imagery group did well on Passage B while the two control groups (especially Group 2) did not. Again, it is possible that a large number of individuals in the two control groups lacked the background for understanding the concepts presented in Passage B.

Other relevant findings stem from the results of the analysis of the questionnaire data. Several research studies emphasize the importance of some kind of imagery training (Montague and Hess, 1978; Pressley, 1976; Anderson and Kulhavy, 1972). The results of this study confirm the importance of imagery as it relates to the comprehension and retention of content area material. Virtually 100 percent of the subjects in all groups reported that they used imagery to aid in their comprehension and/or retention. However, those in the study who received the training scored consistently higher than those in either of the control groups. These results substantiate conclusions prevalent in other studies where imagery has been utilized with prose material.

Studies by Lesgold et al. (1974-1976), Montague and Carter (1973), and Levin (1972) suggested that adults image spontaneously. The fact that 100 percent of the 41 subjects in the study stated that they employed imaging techniques (at least from their own perception) supports this assertion. The consistently higher scores made by the imagery group, however, supports the need for imagery training. These results imply that even if adults do image spontaneously, they may not image advantageously. That is, they may not apply the images formed adequately enough to aid in their comprehension and retention. It should be kept in mind that the subjects in the imagery group were taught a process for imaging, not told specific things to image. They were encouraged to draw on past experiences to create images that would be meaningful to them and consequently aid in their comprehension and retention.

Still other interesting data can be gleaned from the analysis of the questionnaire. Most subjects reported using imagery in conjunction with additional learning strategies. This supports the suggestion made by Kulhavy and Swenson (1975) and Pressley (1976) that imagery be employed in conjunction with other strategies. These data would seem to suggest that perhaps more than one strategy is used spontaneously by college age subjects. Perhaps more than one strategy is required for students to have maximum learning. Of particular interest was the fact that the imaging group employed a more extensive use of covert rehearsal than either the DRA group or the no instruction group. While no one in Group 3 reported use of covert rehearsal as an aid to comprehension, and only 30.77 percent of Group 2 reported using this strategy, 46.15 percent of the experimental group indicated its use. The use of covert rehearsal as an aid to retention had even a wider spread. While 92.31 percent of the imagery group reported using covert rehearsal in conjunction with imagery, 53.85 percent of the DRA group used it, and only 14.29 percent of the no instruction group used it.

An analysis of the questionnaire data may shed light on the reason for the depressed scores on Passage B made by the directed reading activity group. Items 4 and 5 on the questionnaire asked subjects to rate the three passages on ease of imaging and ease of understanding respectively. The results for Group 2 indicated that almost half (46.15 percent) of this group felt that Passage B was the most difficult to image and 40 percent felt that it was the most difficult to understand. This is compared to less than 10 percent of the imagery group reporting Passage B as most difficult to image as well as to understand.

The results of this study also indicate the feasibility of using imagery with high risk students as well as using the technique in a classroom situation. While Levin (1973) found that imagery instructions were beneficial only for those in need of an organizational strategy, the results of this study suggest that induced imagery techniques may benefit poorer readers. This would depend on an operational definition of "poor readers." It was difficult to determine on the basis of the length of the interactions with subjects in the imagery group, which subjects had decoding problems and/or vocabulary deficiencies, or who had these skills in tact and were merely in need of an organizational strategy.

Finally, the results of this study support the feasibility of teaching and using imaging techniques in a classroom situation. Pressley (1976) found this to be true with children. With the expansion of reading programs at the college level to meet the needs of many of the non-traditional students, imagery appears to be a viable technique which could be beneficial to this type of student.

In summary, while a main effect for test, passage, and group was found, an interaction between group and passage was also present. A test for simple effects of group and passage and follow-up comparisons indicated that the imagery group scored significantly higher on the social science passage than the DRA group. Results also indicated that imagery was equally effective for all three content areas. While scores of the two control groups were rather erratic, the scores obtained by the imagery group were consistent.

Analysis of the imagery questionnaire indicated that college level subjects appear to image spontaneously but not necessarily to their academic advantage.

Chapter V summarizes the findings of the study and discusses both theoretical and educational implications. Recommendations for future research are also made.

CHAPTER V
SUMMARY, IMPLICATIONS AND CONCLUSIONS,AND RECOMMENDATIONS

Summary

This study examined the effects of induced mental imagery on high risk college students' comprehension and retention of content area materials. The investigation also sought to determine if materials read from one content area seemed more appropriate than another for the application of imaging techniques. An imagery questionnaire administered at the conclusion of the study supplied information regarding strategies used during text processing.

The study sample consisted of 41 high risk students voluntarily enrolled in a developmental reading course at a local community college. Subjects were randomly assigned by classes to one of three groups: imagery, directed reading activity (DRA), or no instruction. Comprehension scores from the Nelson-Denny Reading Test were collected for all subjects.

Students assigned to the imagery group received two, one-hour training sessions on induced mental imagery techniques during the week prior to the collection of the data analyzed in this study. During the week following the training program, students participated in "warm-up" exercises for induced mental imagery and were reminded to apply imaging techniques as they read one prose passage from biological science material. They then answered 18 comprehension test items on the passage. A vocabulary pretest was also given to identify words that needed further study. One week following the reading of the passage, students took an

18-item retention test as well as the vocabulary posttest. The same procedure was followed the next two weeks when students were given a passage to read from social science material. The procedure was repeated again during the final two weeks of the study when students read a literature passage.

The DRA group received instruction with a traditional directed reading approach each week when they were presented with one of the same passages Group 1 had read. After this instruction they too answered the accompanying 18-item comprehension test and were tested again for retention the following week. This procedure was repeated until students in Group 2 had received direct instruction for reading the three passages and were tested for comprehension and later for retention.

Group 3 merely read the same selections, one each week, with no instruction provided and took the comprehension test. One week after reading each passage, they were tested for retention.

Data were analyzed using a split-plot repeated measures design with one covariate consistent across all repeated measures. In this study the three content area passages served as the repeated measure, and the Nelson-Denny Reading Test was used as the covariate. While the results indicated a main effect for passage, test, and group membership, an interaction between passage and group was also present. Follow-up analyses indicated that imagery was equally effective for all three types of content area material. A comparison of groups on individual passages indicated that the imagery group scored significantly higher than the DRA group on the social science passage. Combined comprehension and retention scores for the directed reading activity group and the no instruction group were rather erratic; the imagery group scored consistently well on all passages. Analysis of the imagery questionnaire supported Levin's (1972) findings that adults appear to image spontaneously. However, imagery training facilitated this trait and increased the comprehension and retention of what was read.

Implications and Conclusions

Theoretical Implications and Conclusions

The results of this investigation suggest several theoretical implications. First, and one of the more important theoretical aspects, is that there appears to be a much more complex relationship between the concreteness-abstractness value of a passage in conjunction with its ease of understanding and imaging ability. The tie-in to past perceptual experiences is perhaps more important than concreteness in one's ability to image, comprehend, and retain. All passages used in the study were rated for imaging value by an independent sample of subjects. Results of these ratings indicated that all three passages were of equal imaging value as measured by the Voss-Newell Imagery Rating Scale. Yet, when subjects in the actual study were asked to rate the passages according to imaginal ease, a wide range of ratings occurred even though subjects were instructed to rate all passages equally if they appeared to be equally imaginal. The range of ratings suggests that individuals may find selections to which they can relate experiences from their own backgrounds easier to image and consequently comprehend.

These data also imply that subjects trained in imaging strategies tend to retain as much as they comprehend initially. This trend was not found either in the directed reading activity group or in the no instruction group. Along these same lines, scores on the comprehension and retention tests followed the same pattern. This finding could be expected. If initial comprehension scores were high for a given individual or group, retention scores would also be high; if initial comprehension scores were low, then retention scores could also be expected to be low.

The main effect for type of test, comprehension or retention, also has important theoretical implications. Results of this study indicated that scores on the comprehension test were statistically higher than scores on the retention test. Yet, every study that has been conducted investigating imagery and prose material has used an immediate or delayed recall task as a means of assessing the amount comprehended. If comprehension scores are consistently higher than retention scores, it would seem that researchers should be more careful in their definition of comprehension. While patterns of comprehension and retention may be the same, comprehension and retention scores did differ significantly in this study.

Three theoretical questions concerning the relationship between imaging and comprehension were raised. Does imagery enable comprehension to occur? Must comprehension occur prior to imagery? Is there an overlap between comprehension and imagery? From the results of these data, as well as the operational definition of imaging strategies used in this study, it would appear, at least to some extent, that imagery enables comprehension to occur. This finding is supported by the fact that before comprehension can occur there must somehow be a tie-in to experiential background. If imagery is taught in such a way that subjects are instructed to make images personal, it seems only natural that some form of imaging must take place prior to comprehension. This imaging may trigger a deeper understanding, make retention greater, and/or initiate understanding.

The results of the imagery questionnaire showed that 100 percent of all subjects reported the use of imagery in comprehension and/or retention tasks. This would seem to contradict the position of the descriptionalists that all information is stored in the brain as propositions. If all information were stored in the brain as propositions--a series of assertions that must be either true or false--and only these propositions were used in the comprehension process, it seems that 100 percent of all subjects would not have reported using imagery even though two-thirds of the sample received no imagery training. Additionally, it would seem that there should be some relationship between how information is retrieved and how it is stored in the brain.

Finally, the fact that most subjects reported using other strategies along with imagery may add support to Paivio and Csapo's (1973) dual code theory. They suggest that more concrete words (sentences or ideas) are represented by both images and verbal strings while abstract words (sentences and ideas) are represented only with verbal strings. The reporting of the use of imagery in conjunction with verbal strategies (i.e., covert rehearsal, rereading, paraphrasing) may imply that more than one type of representation exists. This implication may not be necessarily in the way Paivio and Csapo suggest (concrete versus abstract) but in different types and forms of representation depending on experiential background, type of material, and conceptual level of the material.

Educational Implications and Conclusions

Several educational implications also emerged as a result of this investigation. It would appear that imagery can be taught effectively in group situations. In fact,when using induced imagery rather than imposed imagery, group situations may be more advantageous. Students can discuss the different images formed and subsequently can be shown that any image which promotes the individual reader's comprehension and/or retention is a useful one.

The consistency of the scores within the imagery group across all three passages generates several ideas. First, induced imaging techniques appear to be successful for use with any materials in the content areas used. The fact that the selections were not as long as a text chapter but longer than reading selections found in texts designed for use in developmental reading courses at the college level has important implications. It appears that somehow imaging involves students in text. Using the techniques requires them to think about and synthesize information to formulate interactive images. It may, as Levin (1973) suggests, provide an organizational strategy and when used in conjunction with other learning techniques, provide significant improvement in comprehension and retention.

Second, imagery appears to be effective with high risk students and gives educators associated with developmental education at the college level still another strategy for increasing understanding in content area subjects. If students can be taught to utilize their experiential background in forming images, they should gain a better understanding of a content area chapter. This type of imagery would aid in the reading of all subject areas. It gives students the beginning of a comprehension process. It forces them to ask the question, "Does this make sense?"

An ancillary educational implication surfaced when the data were analyzed. The data implied that a directed reading approach used with high risk college students is not as effective as teachers are led to believe. A re-examination of the data presented in this investigation indicates that the group receiving no instruction often scored higher than the DRA group. This could result from a conflict between the organizational patterns of the instructor and student, perhaps even with different types of content material. Perhaps the purposes set by the instructor do not adequately tie-in to a student's experiential background and, therefore, are not meaningful. If one of the keys to successful comprehension is involvement, perhaps purpose setting by instructors and reading for those purposes conflicts with rather than compliments comprehension and retention. Since subjects used in this study were both high risk and college students, it is not known whether this trend would exist for college students not classified as high risk.

The results of the study may also have implications concerning testing methods in the classroom. The findings point out the need to investigate further the differences between a comprehension task and a retention task. If comprehension scores on a passage to which students have access are significantly higher than the scores on the retention test, it would seem that an accurate assessment is not being made of an individual's comprehension. This relates to a previously quoted statement by Crowder (1976) regarding the differences between comprehension and retention. The possibility exists that a true test of one's ability to comprehend content material would be one in which individuals have access to the material during a testing situation. Additionally, in a true test of how much an individual can remember or retain, the individual should not have access to the materials. Most testing situations at the college level appear to be testing the latter, and therefore, would be considered tests of retention.

Recommendations for Future Research

The findings of this study suggest that the use of imagery tends to increase the comprehension and retention of what is read, but an interaction between passage and group makes the relationship somewhat unclear and inconclusive. The findings support the past research of Lesgold et al. (1974-1976) and Pressley (1976), but somewhat contradicts Paivio's (1966) concrete-abstract theory of imaginal ease and understanding. The results of this study also raise questions concerning the claim of Steingart and Glock (1979) that all material is stored in the memory as images. In addition, it raises questions regarding the findings by Anderson and Kulhavy (1972) which claim that spontaneous imaging automatically results in better comprehension and retention.

As a result of this study several recommendations for future research can be made.

This investigation was conducted with a rather small sample size. Because of this, it was difficult to draw strong causal inferences concerning the relationship between induced mental imagery and the comprehension of content materials. While certain trends were evident, others were masked due to the interaction between group and passage. Therefore, this study needs to be replicated using a larger, completely randomized sample size to see if the relationship can be further clarified.

One of the problems inherent in using a repeated measures design is the possibility of the occurrence of an ordering effect. Because of the limitations of the facilities in which the study was conducted and the small number of subjects available, it was not possible to give the passages in different orders. While the results of this study gave no indication that an ordering effect did occur, it might be advantageous to carry out this investigation using all possible orderings to determine if an interaction between order and group would surface.

Another suggestion for future research stems from the finding that a majority of subjects in this study reported using imagery in conjunction with other learning strategies. This is consistent with the findings of Kulhavy and Swenson (1975). Perhaps research combining imagery techniques with such strategies as covert rehearsal, paraphrasing, networking, summarizing, or mnemonics may provide further insight into combinations of learning strategies that would be effective in applying to content materials. For example, the results of the imagery questionnaire clearly imply that for these students imagery may be effective with covert rehearsal.

Since this investigation was the first to compare passages from a variety of content areas but was conducted on a very specific type of population, further exploration using either heterogeneous populations or subjects of different ages appears to be needed. If the present trend continues, the numbers of non-traditional students enrolled in both two- and four-year institutions will continue to rise. This trend warrants further investigations into more sophisticated training procedures for teaching imaging techniques as well as research into additional ways these techniques can be applied advantageously to content area materials.

Follow-up investigations would provide information concerning whether or not students continued to apply the techniques to studying and reading in their academic courses. No strategy is beneficial unless there is some carry over into the practical application of it. It might also be helpful to include an item on the imagery questionnaire which asks if subjects are applying the techniques outside of the experimental setting.

Additional research could involve using longer passages. This would be especially important in settings where students are expected to read, synthesize, and retain lengthy expository materials. Only one other study (Anderson and Kulhavy, 1972) used a passage which was longer than those used in this investigation. This is an area ripe for research since little is known about utilizing imaging strategies with entire chapters of text material.

One of the interesting findings of this study was the very small difference between the average comprehension and retention scores for the imagery group. Additional research is needed to clarify further the role imagery plays in comprehension and retention. While Pressley (1976) suggests that imagery is effective only with highly imaginal passages, the results of this study do not totally concur with that suggestion.

More research needs to be conducted regarding the feasibility of group instruction for imaging. The results of this study as well as previous work by Levin (1972) and Pressley (1976) indicate the plausibility of group instruction using imagery, but both Levin and Pressley conducted their research with younger subjects. In general, additional research should be conducted with high risk college age students.

A final recommendation involves the finding that, in several instances, the group receiving no instruction out-performed the DRA group. More investigations need to be made to determine if these findings are consistent or if the sample used in this investigation was atypical.

APPENDIX A

INSTRUMENTATION

DIRECTIONS:

Each of you has a short prose passage and a rating sheet containing twenty items.

Please read the passage. After you have completed your reading, rate the passage on the rating sheet. Indicate your rating of the passage by circling the appropriate number to indicate your rating of the passage on _each pair_ of items.

For example, if you were to rate the passage on the rating item Simple . . . Complex, and you felt that it was very complex, you would circle the number seven (7); if it was rather simple, you would circle one (1) or two (2); if it was about half-way between simple and complex, your rating on the item would probably be a four (4). _Circle only one (1) number for each item pair_.

PLEASE COMPLETE EACH ITEM PAIR FOR THE PASSAGE.

Voss-Newell Imagery Rating Scale

1)	Easy	1	2	3	4	5	6	7	Difficult
2)	Concrete	1	2	3	4	5	6	7	Abstract
3)	Ambiguous	1	2	3	4	5	6	7	Clear
4)	Coherent	1	2	3	4	5	6	7	Incoherent
5)	Active	1	2	3	4	5	6	7	Passive
6)	Semantic	1	2	3	4	5	6	7	Sensory
7)	Non-Verbal	1	2	3	4	5	6	7	Verbal
8)	Dull	1	2	3	4	5	6	7	Interesting
9)	Descriptive	1	2	3	4	5	6	7	Conceptual
10)	Meaningful	1	2	3	4	5	6	7	Rote
11)	Useful	1	2	3	4	5	6	7	Useless
12)	Linguistic	1	2	3	4	5	6	7	Perceptual
13)	Indirect	1	2	3	4	5	6	7	Direct
14)	Obscure	1	2	3	4	5	6	7	Vivid
15)	Objective	1	2	3	4	5	6	7	Subjective
16)	Pictoral	1	2	3	4	5	6	7	Symbolic
17)	Wordy	1	2	3	4	5	6	7	Concise
18)	Specific	1	2	3	4	5	6	7	General
19)	Hinders	1	2	3	4	5	6	7	Helps
20)	Confuses	1	2	3	4	5	6	7	Clarifies

T_1 Passage--Intelligence

There are two factors which determine an individual's intelligence. The first is the sort of brain he is born with. Human brains differ considerably, some being more capable than others. But no matter how good a brain he has to begin with, an individual will have a low order of intelligence unless he has opportunities to learn. So the second factor is what happens to the individual--the sort of environment in which he is reared. If an individual is handicapped environmentally, it is likely that his brain will fail to develop and he will never attain the level of intelligence of which he is capable.

The importance of environment in determining an individual's intelligence can be demonstrated by the case history of the identical twins, Peter and Mark X. Being identical, the twins had identical brains at birth, and their growth processes were the same. When the twins were three months old, their parents died and they were placed in separate foster homes. Peter was reared by parents of low intelligence in an isolated community with poor educational opportunities. Mark was reared in the home of well-to-do parents who had been to college. He was read to as a child, sent to good schools, and given every opportunity to be stimulated intellectually. This environmental difference continued until the twins were in their late teens, when they were given tests to measure their intelligence. Peter's I.Q. was 85, well below the level he might have attained if reared under average conditions. Mark's I.Q. was 125, twenty-five points above average and fully forty points higher than his identical brother. Given equal opportunities, the twins, having identical brains, would have tested at roughly the same level.

T_1 Passage--Intelligence

1. Which of the following intelligence quotients would be the closest to an average I.Q.?
    a. 112
    b. 99
    c. 89
    d. 120

2. The main idea of this article is
    a. twins rarely have the same I.Q.
    b. the size of one's brain determines intelligence
    c. extremely wealthy people have smarter children
    d. environmental factors are of great importance in determining a person's intelligence

3. It can be interred from this article that
    a. Peter probably was not read to as a child
    b. Peter probably was not loved as a child
    c. Mark probably was smarter at the time he was placed in the foster home
    d. Peter's parents had a college education

T2 Passage--Animal Intelligence

Of all the animals in the animal kingdom, which one (aside from man) is the smartest?

There are several ways of measuring the intelligence of animals. In one test a scientist sets three identical cans on a table. While the animal watches, he puts food under one of the cans. Then he leads the animal away. Some time later, he brings it back to see if it remembers which can has the food. No sniffing is allowed; the animal must go directly to the correct can or it fails.

This is called a delayed-response test. The idea is to find out how long an animal's memory can retain information. The scientists would try showing the cans to the animal one hour later, or two hours later, or even a full day later. They discovered that chimpanzees and elephants have the best memory, and are able to remember the correct can for at least twenty hours. No other animal is close. Dogs came next, but they only remembered for nine hours.

To settle the matter, the scientists devised a gigantic maze and ran the chimps and elephants through it. The maze was very complicated, with many blind alleys and dead ends. It took the chimps ten minutes to find their way out. The elephants needed a half hour. Even allowing for the elephants' slower rate of speed, the test indicates that chimpanzees are the smartest animals.

From this and other tests, the scientists drew the following conclusion: An animal's intelligence depends on the size of its brain in proportion to the size of its body. The elephant's brain weighs ten pounds. But this is only 1/600th of its 6,000 pound body. A chimp's brain weighs about one pound, or 1/20th of its total body weight. So in proportion to its body size, the chimp has four times as much brain as the elephant--more brain for less body. The chimp is the champ!

T_2 Passage--Animal Intelligence

1. A delayed-response test actually tests an animal's
   - a. speed of recognition
   - b. I.Q.
   - c. achievement
   - d. retention

2. The chimpanzee's brain is approximately ____________________ percent of it's body weight?
   - a. 5
   - b. 2
   - c. 20
   - d. 50

3. A chimpanzee remembers more than ________________ percent longer than a dog.
   - a. 100
   - b. 150
   - c. 200
   - d. 250

4. According to this passage, which animal would be the smartest?
   - a. Body weight = 300 pounds. Brain weight = 10 pounds.
   - b. Body weight = 40 pounds. Brain weight = 2 pounds.
   - c. Body weight = 150 pounds. Brain weight = 10 pounds.
   - d. Body weight = 60 pounds. Brain weight = 1 pound.

5. The maze experiment was devised to
   - a. find out how long it took all animals to go through the maze
   - b. show that elephants were slower but smarter
   - c. determine if elephants or chimps were smarter
   - d. test the speed of dogs and chimps

T_3 Passage--The Merchant

Once upon a time a worthy merchant of London, named Gilbert a Becket, made a pilgrimage to the Holy Land, and was taken prisoner by a Saracen lord. This lord, who treated him kindly and not like a slave, had one fair daughter, who fell in love with the merchant, and who told him that she wanted to become a Christian, and was willing to marry him if they could fly to a Christian country. The merchant returned her love until he found an opportunity to escape, when he did not trouble himself about the Saracen lady, but escaped with his servant, Richard, who had been taken prisoner along with him, and arrived in England.

The Saracen Lady, who was more loving than the merchant, left her father's house in disguise to follow him, and made her way after many hardships to the seashore. The merchant had taught her only two English words (for I suppose he must have learned the Saracen tongue, and made love in that language), of which London was one, and his own name, Gilbert, the other. She went among the ships saying, "London! London!" over and over again, until the sailors understood that she wanted to find an English vessel that would carry her there; so they showed her such a ship, and she paid for her passage with some of her jewels, and sailed away.

Well, the merchant was sitting in his countinghouse in London one day, when he heard a great noise in the street; and presently his servant Richard came running in from the warehouse, with his eyes wide open and breath almost gone, saying, "Master, master, here is the Saracen lady." The merchant thought Richard was mad; but Richard said, "No, master. As I live, the Saracen lady is going up and down the city calling 'Gilbert, Gilbert!'" Then he took the merchant by the sleeve, and pointed out the window; and there they saw her among the gables and water spouts of the dark, dirty street, in her foreign dress, so forlorn, surrounded by a wondering crowd, and passing slowly along, calling "Gilbert, Gilbert!"

When the merchant saw her, and thought of the tenderness she had shown him in his captivity, and of her constancy, his heart was moved, and he ran down into the street; and she saw him coming, and with a great cry fainted in his arms. They were married without loss of time, and Richard (who was an excellent man) danced with joy the whole day of the wedding; and they all lived happy ever afterwards.

T_3 Passage--The Merchant

1. We can infer from the article that Saracen was
    a. a Christian country
    b. not a Christian country
    c. in the Holy Land
    d. near London

2. Which of the following best describes Gilbert's initial motives for having a relationship with the Saracen lady?
    a. He was in love with her.
    b. He wanted her father to take him to London.
    c. His servant was in love with her.
    d. He used her.

3. Gilbert had a change of heart about the Saracen lady because
    a. he realized how much she was devoted to him
    b. his servant encouraged Gilbert to marry her
    c. she knew no one in London
    d. she refused to return to her own country

4. The Saracen lady made her way to London by
    a. being a stow away on a luxurious ship
    b. begging Saracen sailors to take her there
    c. purchasing her own sailing vessel
    d. paying for her way with her possessions

5. When Richard first told Gilbert of the Saracen presence in London, Gilbert
    a. was overjoyed
    b. ran away
    c. felt that Richard was crazy
    d. ran to greet her

Vocabularly List

Passage A--"The Long, Cold Sleep"

The words listed below are found in the following passage. Since their definitions may aid you in the understanding of the passage, you may refer to them at anytime during your reading.

1. drought--a long period of time with no rain
2. detected--discovered
3. stethoscope--an instrument used for listening
4. marmots--furry, burrowing rodents
5. defenseless--unprotected; having no defense
6. consuming--using up
7. starvation--lacking to the point of perishing
8. exposure--leave open or unprotected
9. stupor--loss of sensibility
10. potent--very strong
11. revived--brought back
12. cruel--mean; hateful
13. hoax--prank; trick
14. fiction--made up

Vocabulary Pretest

Passage A--"The Long, Cold Sleep"

1. a summer drought
   a. shower
   b. crop
   c. without rain
   d. vacation

2. Detected the problem
   a. attacked
   b. discovered
   c. answered
   d. considered

3. the cold stethoscope
   a. instrument for listening to the heart
   b. instrument for looking into the eye
   c. instrument for looking into the ear
   d. instrument for taking the blood pressure

4. furry marmots
   a. burrowing rodents
   b. monkeys
   c. animals
   d. bears

5. defenseless infant
   a. abandoned
   b. orphaned
   c. strong
   d. unprotected

6. consuming food
   a. using up
   b. destroying
   c. cooking
   d. buying

7. starvation diet
   a. lacking
   b. perish
   c. fasting
   d. prolonged

8. exposure to the sun
   a. lacking
   b. overly protected
   c. covered
   d. leave unprotected

9. a drunken stupor
    a. brave
    b. loss of sensibility
    c. companion
    d. hangover

10. the potent medicine
    a. incorrect
    b. brand-new
    c. strong
    d. liquid

11. revived from sleep
    a. kept
    b. protected
    c. eliminated
    d. brought back

12. cruel prank
    a. mean
    b. unimportant
    c. childish
    d. funny

13. obvious hoax
    a. error
    b. example
    c. answer
    d. trick

14. modern fiction
    a. lies
    b. novel
    c. truth
    d. romance

"A Long, Cold Sleep"

by

Harold Schmeck

Today no scientist on Earth knows whether or not human hibernation is possible, but most suspect it is not. Certainly no one has any idea how a man might be put into such a state or how he might be safely brought out of it again. We don't even know what causes hiberation in animals, or what brings it to a safe end when spring comes.

Hibernation is a state in which an animal seems to close down the throttle on his whole body. Temperature drops almost to the freezing point and heartbeat and breathing fade away almost to a standstill. Every function of life seems to shift into low gear; the animal uses little energy and needs almost no food.

The reason for hibernating is clear; an animal hibernating safe underground can survive a winter in which it might starve or freeze if it tried to stay active and aboveground. Some desert creatures have the same ability to throttle down to a near standstill in periods of great heat and drought. This is called aestivation, but basically it is the same process as hibernation.

But what is that process and how does it work? Scientists have watched animals do it, but they have never learned the secret. It is one of the great puzzles of modern biology. Only a few animals have learned the trick, and they are all small creatures at that. A bear does not really hibernate; it simply goes to sleep and lives off its own fat during the winter. Neither its heartbeat nor its breathing slows down.

One creature that really does hibernate is the Arctic ground squirrel, which spends almost half its life asleep. The little animals live north of the Arctic Circle, where the winters are long and bitter cold. The ground squirrels must go underground by the end of September, and they don't come out again, except briefly, until May.

The squirrel builds itself an underground nest lined with hair and grass and whatever else it can find. The nest is stocked with seeds and other food; then the squirrel crawls in, curls up in a ball, and goes to sleep. Gradually its body temperature drops until it reaches the middle 30s--just a degree or so above the freezing point of water. Its breathing becomes slower and fainter until the animal is taking only about three breaths a minute. The heartbeat fades away until it can hardly be detected with a stethoscope.

The ground squirrel doesn't sleep continuously through the entire cold season, but wakes up occasionally, eats a few of the seeds collected in the fall, and then, if the squirrel is lucky and undisturbed, goes back into its strange cold sleep for another long nap.

Not until spring does it really come out to look the world in the face again; to find a mate and a hearty meal and to start fattening up again for the next winter, only about five months away.

Marmots, hamsters, some bats, and a few species of brids also hibernate in the wild. It isn't as easy a way out as you might think, because the hibernating animal is defenseless all winter and the hibernation itself costs the body a lot. The process affects the teeth and the digestive system and probably other parts of the body as well and seems really to be a borderline state between life and death.

Doctors have used something a little like hibernation to help patients through difficult surgery. This is called hypothermia--simply a process of cooling the body, or a part of it, with the help of ice water. The purpose is to stop the patient's brain from working so har; for even when you are asleep, your brain is using energy and consuming oxygen from the blood.

If that supply of oxygen is cut off for as little as five minutes, brain cells can never recover and usually the patient dies. Even those who survive this kind of brain damage seldom awaken, although they often live for weeks or months.

But when the brain is cooled it can withstand far longer periods of oxygen starvation. Surgeons who must interrupt a patient's blood circulation while operating on the heart or the brain have used hypothermia to buy extra minutes in which they can save a life.

But in hypothermia the patient's temperature is seldom reduced more than ten or fifteen degrees below the normal 98.6, and the low-temperature period lasts only a few hours at the most.

Even in out-of-door accidents in which people have risked freezing to death from cold exposure, no human has been known to survive if his body temperature dropped below 65 degrees. Even at 86 degrees one will be in a state of stupor, and at 80 one is almost sure to be unconscious. Yet the Arctic ground squirrel in Alaska cools down to the middle 30s every winter.

If doctors could really make their patients hibernate, they might have a potent new weapon against disease. Probably some infections could be cured through hibernation and new ways could be found to treat heart problems and cancer.

But doctors cannot do it, and freezing, even of parts of the body, is a goal even farther beyond reach. Some cells growing in laboratory flasks can be frozen and later revived, and some tissues can be frozen and preserved, but they aren't alive at the end of the process.

No human organ, such as a kidney, lung, or heart, can be frozen today without damaging it beyond repair--blood, skin, and bone are about the only things that can be used at all after careful freezing.

As for the idea of freezing a person after his death and then reviving him later after we learn how to cure his fatal disease, many experts in low-temperature biology think this is so slim a chance as to amount to a cruel hoax on those who believe in it. Damage to the body starts before death. Brain damage can occur in minutes and the freezing itself does more harm. To revive a person after all this is not a matter or curing a disease, but rebuilding an entire human being.

Scientists may someday solve the riddle of human hibernation, and then space travel many light-years beyond the earth, but that fantastic accomplishment in renewing human life--freezing a living person and reviving him at a later date--may never be possible except in science fiction.

Comprehension Questions

"A Long, Cold Sleep" by Harold Schmeck

1. Which of the following does not occur during hibernation?
   - a. The animal uses an abundance of energy.
   - b. The animal eats small amounts of food.
   - c. The animal's heartbeat slows considerably.
   - d. The animal's temperature drops drastically.

2. Hibernation is most similar to
   - a. hypothermia
   - b. freezing body organs
   - c. aestivation
   - d. unconsciousness

3. When the brain is deprived of oxygen for more than five minutes
   - a. the patient dies immediately
   - b. brain cells die
   - c. doctors gain more time for surgical procedures
   - d. it can be cooled easier

4. Which of the following would have the least chance of being damaged if frozen?
   - a. a liver
   - b. a toe
   - c. an eye
   - d. an appendix

5. A bear does not really hibernate since
   - a. he eats during this period
   - b. he spends such a short time dormant
   - c. his heartbeat does not change
   - d. his breathing quickens

6. If the arctic ground squirrel lived eight years, how much of that time would have been spent sleeping?
   - a. two years
   - b. three years
   - c. four years
   - d. impossible to tell

7. Which of the following is not true about hypothermia?
   - a. It gives the doctors precious extra time for surgery.
   - b. It is usually used during heart or brain surgery.
   - c. The patient's body (or part of it) is cooled with ice water.
   - d. The patient's temperature is usually kept at about 75 degrees.

8. Hibernation causes difficulty for animals because
   - a. it is difficult for their body to begin functioning again.
   - b. they can be easily attacked by their enemies.
   - c. they lose a substantial amount of weight.
   - d. they may not consume enough oxygen to keep them alive.

9. The article suggests that knowing more about hibernation could aid in helping
   a. larger animals
   b. hypothermia techniques
   c. desert animals
   d. astronauts

10. During hibernation, the body temperature in animals is
    a. just above freezing
    b. just below freezing
    c. right at freezing
    d. about 10 degrees below normal body temperature

11. If the body temperature of a human dropped below 60 degrees we can assume that
    a. brain damage would occur
    b. frostbite would occur
    c. damage would occur to the heart and kidneys
    d. death would occur

12. All of the following are valid arguments for further study of hibernation except that
    a. more animals could learn to adopt hibernation techniques
    b. advancements could occur in surgical techniques
    c. it could help in understanding how body organs could be frozen
    d. it could help treat cancer and heart attack

13. Presently, the thought of freezing a human and later reviving him/her is
    a. feasible but not practical
    b. not researchable but fascinating
    c. impossible but worthy of research
    d. impractical but possible

14. The main idea of this article is that
    a. hibernation only occurs in small animals
    b. hibernation is a complex process about which little is known
    c. hypothermia is as close to hibernation that humans can come
    d. hibernation could be a powerful weapon against disease

15. The purpose of dropping the temperature of the brain during surgery is to
    a. put the patient under sedation with greater ease
    b. allow the patient to be in a conscious state during an operation
    c. slow down the flow of blood to the brain
    d. prevent the brain from utilizing too much energy

16. Tissues that are frozen and preserved
    a. can be grown in a laboratory
    b. are not alive at the end of the process
    c. are new weapons to fight cancer
    d. are used in hypothermia procedures

17. Desert animals hibernate when
    a. night temperatures fall below zero for extended periods of time
    b. there are severe sand storms for extended periods of time
    c. there are extended periods of extreme heat and no rain
    d. their body temperature rises above normal for extended periods of time

18. Which of the following does not hibernate?
    a. bears
    b. bats
    c. certain birds
    d. some squirrels

Retention Questions

"A Long, Cold Sleep" by Harold Schmeck

1. If the body temperature of a human dropped below 60 degrees we can assume that
   1. frostbite would occur
   2. death would occur
   3. damage would occur to the heart and kidneys
   4. brain damage would occur

2. During hibernation, the body temperature in animals is
   1. about 10 degrees below normal body temperature
   2. just below freezing
   3. right at freezing
   4. just above freezing

3. All of the following are valid arguments for further study of hibernation except that
   1. advancements could occur in surgical techniques
   2. it could help in understanding how body organs could be frozen
   3. it could help treat cancer and heart attack
   4. more animals could learn to adopt hibernation techniques

4. Which of the following does not hibernate?
   1. bears
   2. certain birds
   3. some quirrels
   4. bats

5. Hibernation causes difficulty for animals because
   1. they may not consume enough oxygen to keep them alive
   2. it is difficult for their body to begin functioning again
   3. they can be easily attacked by their enemies
   4. they lose a substnatial amount of weight

6. Which of the following is not true of hypothermia?
   1. It is usually used during heart or brain surgery
   2. It gives doctors precious extra time for surgery
   3. The patient's body (or part of it) is cooled with ice water
   4. The patient's temperature is usually kept at about 75 degrees

7. Tissues that are frozen and preserved
   1. are not alive at the end of the process
   2. can be grown in a laboratory
   3. are used in hypothermia procedures
   4. are new weapons to fight cancer

8. The main idea of this article is that
   1. hibernation is a complex process about which little is known
   2. hibernation could be a powerful weapon against disease
   3. hibernation occurs in small animals
   4. hypothermia is as close to hibernation that humans can come

9. Which of the following would have the least chance of being damaged if frozen?
    1. a liver
    2. a toe
    3. an eye
    4. an appendix

10. Presently, the thought of freezing a human and later reviving him/her is
    1. impractical but possible
    2. not researchable but fascinating
    3. feasible but not practical
    4. impossible but worthy of research

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    2. he eats during this period
    3. he spends such a short time dormant
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    4. The animal's heartbeat slows considerably.

14. Hibernation is most similar to
    1. unconsciousness
    2. hypothermia
    3. aestivation
    4. freezing body organs

15. The purpose of dropping the temperature of the brain during surgery is to
    1. prevent the brain from using too much energy
    2. slow down the flow of blood to the brain
    3. allow the patient to be in a conscious state during an operation
    4. put the patient under sedation with greater ease

16. Desert animals hibernate when
    1. there are severe sand storms for extended periods of time
    2. their body temperature rises above normal for extended periods of time
    3. there are extended periods of extreme heat and no rain
    4. night temperatures fall below zero for extended periods of time

17. If the Arctic ground squirrel lived eight years, how much of that time would have been spent sleeping?
    1. impossible to tell
    2. four years
    3. three years
    4. two years

18. The article suggests that knowing more about hibernation could aid in helping
    1. astronauts
    2. desert animals
    3. larger animals
    4. hypothermia techniques

Vocabulary Posttest

Passage A-"The Long, Cold Sleep"

1. a drunken stupor
   a. loss of sensibility
   b. hangover
   c. brave
   d. companion

2. modern fiction
   a. romance
   b. truth
   c. novel
   d. lies

3. starvation diet
   a. fasting
   b. perish
   c. lacking
   d. prolonged

4. defenseless infant
   a. strong
   b. orphaned
   c. abandoned
   d. unprotected

5. revived from sleep
   a. protected
   b. brought back
   c. kept
   d. eliminated

6. a summar drought
   a. vacation
   b. crop
   c. shower
   d. without rain

7. the cold stethoscope
   a. instrument for listening to the heart
   b. instrument for taking the blood pressure
   c. instrument for looking into the ear
   d. instrument for looking into the eye

8. cruel prank
   a. childish
   b. mean
   c. funny
   d. unimportant

9. obvious hoax
    a. error
    b. trick
    c. example
    d. answer

10. detected the problem
    a. attacked
    b. considered
    c. answered
    d. discovered

11. the potent medicine
    a. brand-new
    b. incorrect
    c. liquid
    d. strong

12. exposure to the sun
    a. lacking
    b. covered
    c. overly protected
    d. leave unprotected

13. furry marmots
    a. burrowing rodents
    b. bears
    c. monkeys
    d. animals

14. consuming food
    a. destroying
    b. using up
    c. buying
    d. cooking

Vocabulary List

Passage B--"Immortality Syndrome"

The words listed below are found in the following passage. Since their definitions may aid you in the understanding of the passage, you may refer to them at anytime during your reading.

1. impending--soon to occur
2. ceremonious--a formal occasion
3. bereaved--surviving
4. homage--to pay tribute
5. Spartan--brave; courageous
6. preordained--decreed beforehand
7. taciturn--quiet
8. infatuated--carried away by shallow love
9. bureaucrat--one who insists on following the rules
10. pervasive--wide-spread
11. ideologies--beliefs
12. poignant--touching; sensitive
13. perpetual--constant
14. affirmation--confirmation; agreement
15. entity--separate individual
16. enshrinement--hold sacred
17. overt--not hidden; blatent

Vocabulary Pretest

Passage B--"Immortality Syndrome"

1. impending disaster
   a. past
   b. coon to occur
   c. terrible
   d. natural

2. ceremonious occasion
   a. cheerful
   b. gloomy
   c. formal
   d. planned

3. bereaved widow
   a. tearful
   b. cautious
   c. beautiful
   d. surviving

4. to pay homage
   a. attention
   b. dutifully
   c. dues
   d. tribute

5. Spartan characteristics
   a. noble
   b. justifiable
   c. masculine
   d. brave

6. preordained rite
   a. voted
   b. improper
   c. decree beforehand
   d. inappropriate

7. taciturn man
   a. quiet
   b. gentle
   c. talkative
   d. ignorant

8. infatuated adolescent
   a. extremely studious
   b. rebellious
   c. carried away by shallow love
   d. fun-loving

9. sly bureaucrat
    a. one who insists on following rules
    b. one who goes against policy
    c. one who heads a large corporation
    d. one who is very wealthy

10. pervasive feeling
    a. guilty
    b. withheld
    c. wide-spread
    d. nonexistent

11. religious ideologies
    a. beliefs
    b. holidays
    c. artifacts
    d. documents

12. poignant story
    a. violent
    b. mysterious
    c. well-written
    d. touching, sensitive

13. perpetual motion
    a. circular
    b. constant
    c. interrupted
    d. slow

14. affirmation of love
    a. denial
    b. disagreement
    c. justification
    d. confirmation

15. corporate entity
    a. president
    b. policy
    c. separate individual
    d. attorney

16. enshrinement of a loved one
    a. burial
    b. holding sacred
    c. denial
    d. loss

17. overt behavior
    a. unacceptable
    b. proper
    c. not hidden
    d. understandable

"Immortality Syndrome"

by

James Gollin

The big question for the friends and relatives of a dying man is, Does he know? Should we tell him? We spend a lot of time agonizing over this problem. But our instincts--or at least some very strong social reflexes--advise us to keep quiet. To tell him of his impending death, we fell, may tip the balance against him and against ourselves. Death, not life, would then take control.

Just as we feel we must press life upon the dead and dying, so do we carry death back into life by our acts of mourning. In some ways, moreover, our mourning is as formal and ceremonious as that of societies where the bereaved wear black, retire from life, and set aside a time to weep.

For us, the real act of homage to the dead is to keep on going. Such mourning in reverse is also a ritual test of endurance, a deliberately Spartan demonstration of our ability to carry someone else's death with us into our own life. In "going on as if nothing happened," there is the unmistakeable sense of participating in a preordained rite. We behave almost like those people in primitive societies who believe that the "life force" of the dead enteres into a close relative. In order to preserve that life force intact, such peoples insist upon continuing their own lives. If they should stop life in order to weep, they imperil the soul of the deceased.

Just as we place a kind of taboo on overt demonstrations of grief, so do we also restrict talk about our own death. To name a thing is to evoke it, so it's better not to speak of your death. But that we choose to be taciturn about this subject doesn't mean Americans never mention it or think about it. Rather, we feel that there are much better ways than mere conversation to bring death before us.

Going about our daily affairs, we habitually flirt with death in ways that terrify strangers. Of this, the crowning example is the American automobile. We're more than half aware of its perils; yet we nevertheless love the automobile with a terrible passion. Even on a trivial errand the car gives us a chance to test ourselves against death and win.

For the same reason we are infatuated with such sickeningly dangerous sports as skiing, skin-diving, hunting, surfing, and craziest of all, parachuting out of airplanes for fun. And what about the pedestrian's own version of bullfighting, with oncoming cars as toros? Or the acrobatics we perform on shaky ladders when we climb up to fix the roof? Unthinkingly--but with such zest--everybody plays games like these. And far from being afraid to face death, Americans obviously love to have it near at hand. For without death, what would become of our feeling that life is a series of victories?

As in every other society, our heroes are only enlargements of ourselves, doing (though naturally on a heroic scale) what we ourselves do. For instance, Americans have one hero who is a bureaucrat. He has to show up at the office in the morning. He detests, but nevertheless completes, stacks of paperwork. He submits to periodic job interviews. He's afraid of his boss, uneasy about his pension, and he often thinks half-heartedly about resigning. In private life, moreover, this hero is a finicky bachelor who fusses over his food and worries about his weight. He's also vain and a bit of a bore.

His name is James Bond.

James is the servant of the ordinary. Although he's a good shot, he hates guns. His most spectacularly destructive prop is a car. Like a good executive, Bond is at home everywhere. And like a good executive's hero, Bond never dies, but weaves, stumbles, and slips on his way through a world filled to overflowing with death. His reality is a souped-up version of our own.

In turn, our reality certainly cannot be said to shun or shrink away from death. On the contrary, in America death is as pervasive as patriotism. We react to death neither as cowards nor as children ignorant of the truth.

To account for those attitudes, we would have to dig into the American past. We'd have to see how different ideologies have been blended together--how, for instance, our traditional Protestantism has fused with our almost pagan belief in the inexhaustible bounty of the land we inhabit.

We can see then our dual themes, money and death, inevitably converge. And in a society such as ours, what other connection could we make than that money--our great life symbol--is used both symbolically and in fact to abolish death.

The evidence, even on the surface, is both plentiful and poignant to support that hypothesis. Americans don't leave money to pay for perpetual religious services for themselves after death. But our dead do bequeath money to endow universities for the young, hospitals to cure the sick, and research cneters to win out over disease. At the very first glance, our society affords more examples than we can count that Americans think of money as the most important way of making death give place to life.

Life insurance is one of the best examples of our belief that money is life, and as life, helps us triumph over death. Because of that belief, we have made out of buying and selling life insurance a tremendous symbolic process--an almost sacramental one. We don't just own insurance, we believe in life insurance as a symbol of everything we do, think, and feel about defeating death.

Moreover, being Americans, we have carried this inner logic one step further by sponsoring and nurturing an industry--and not a religious, governmental, or charitable institution--to provide insurance. Just as insurance symbolizes our feelings about conquering death, so in turn does any industry, and especially this one, stand for the triumphant affirmation of our inexhaustible welath, perpetual life, and ingenuity at outwitting death. Unlike ourselves, a great corporate entity is immortal.

The enshrinement of life insurance explains some of the industry's curous customs. For instance, to an insurance salesman, it's never "when you die," but "if you die"--as a matter of fact, agents are taught never to be so blunt and impolite as to mention death by name. The favorite theme of the insurance ad is life. The industry talks constantly about the "living values" of insurance. In the ads the illustrations almost always feature children.

According to one sophisticated salesman, "The only reason people buy insurance is they think the policy is a magic charm guaranteeing them against death. And the reason they don't buy is that they're afraid that the God of Death will know and point his finger at them."

We may or may not agree completely with this agent. But we do buy $100 billion worth of insurance every year.

Comprehension Questions

"Immortality Syndrome" by James Gollin

1. According to the article, if you wanted to "live on" after death, you might
   a. have prayers said for your soul
   b. have a large marker placed on your grave
   c. leave a large sum of money to a favorite charity
   d. set up trust funds for all of your children

2. James Bond is used as an example of
   a. a man flirting with death
   b. the American executive
   c. someone we all would like to be
   d. an exaggeration of what we all do in our everyday lives

3. For Americans, the real act of homage to the dead is to
   a. retire from life
   b. wear black for a year
   c. set aside a time for weeping
   d. keep on going

4. People buy life insurance because
   a. they want to protect their family
   b. they want financial security in the future
   c. they are highly pressured by society to do so
   d. they believe that money is life

5. This writer feels that American attitudes toward death and money
   a. are diametrically opposed
   b. have no bearing on each other
   c. are similar to primitive peoples
   d. converge

6. We can infer from the article that if we talked about our own death
   a. it would happen
   b. we would have to try to avoid it
   c. that we could better face death
   d. that we could better deal with the death of a friend or relative

7. According to the author, if your close friend had only a short while to live, you would
   a. spend as much time with him/her as possible
   b. feel comfortable in discussing the matter with him/her
   c. avoid telling him/her at all possible costs
   d. persuade your friend to get his/her life in order

8. According to the article, if you were an insurance sales person, which of the following would you stress with perspective clients?
    a. double indemnity clauses
    b. increasing life expectancy
    c. sudden death payments
    d. family security in the event of the breadwinners death

9. Buying life insurance is a symbolic process in that
    a. it symbolizes protection
    b. it symbolizes defeating death
    c. it symbolizes our need to feel secure
    d. it symbolizes a reduction in fear

10. Which of the following was not mentioned as being a dangerous sport?
    a. football
    b. hunting
    c. skiing
    d. skin-diving

11. The fact that Americans spend billions of dollars every year on insurance indicates that
    a. Americans take death seriously
    b. Americans are betting life insurance companies that they will live a long time
    c. Americans feel that having life insurance protects them from death
    d. Americans are investing in their future

12. We tend not to tell a person that they are dying because
    a. death would take control
    b. they may live after all
    c. it would be too difficult for the family
    d. the medical profession feels that it is better if they do not know

13. According to this writer, if we would not carry on in the event of the death of a loved one, we would be
    a. keeping the life force in tact
    b. harming the soul of the dead
    c. demonstrating Spartan abilities
    d. a martyr

14. We restrict talking about our own death because
    a. we tend to live just for today
    b. if we talk about it, it may happen
    c. we are afraid to die
    d. most people have not had a brush with death

15. The favorite theme of life insurance companies is
    a. family unity
    b. children
    c. life
    d. death

16. Approximately how much do Americans spend on life insurance every year?
    a. 100 billion
    b. 100 million
    c. 10 billion
    d. 10 million

17. Much of the standard sales message developed for insurance companies implies that
    a. the God of Death will get you if you don't buy
    b. insurance is the source of America's inexaustible wealth
    c. you need at least enough insurance to pay for funeral expenses in the event of your death
    d. immortality is included in the policy

18. The American automobile
    a. is our protection against death
    b. helps us flirt with death
    c. is a status symbol
    d. is more important than life insurance

Retention Questions

"Immortality Syndrome" by James Gollin

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    1. the medical profession feels that it is better if they do not know
    2. they may live after all
    3. death would take control
    4. it would be too difficult for the family

Vocabulary Posttest

Passage B--"Immortality Syndrome"

1. sly bureaucrat
   a. one who is very wealthy
   b. one who goes against policy
   c. one who insists on following rules
   d. one who heads a large corporation

2. taciturn man
   a. quiet
   b. talkative
   c. ignorant
   d. gentle

3. religious ideologies
   a. holidays
   b. beliefs
   c. artifacts
   d. documents

4. preordained rite
   a. improper
   b. inappropriate
   c. decree beforehand
   d. voted

5. bereaved widow
   a. cautious
   b. beautiful
   c. tearful
   d. surviving

6. pervasive feeling
   a. withheld
   b. wide-spread
   c. nonexistent
   d. guilty

7. to pay homage
   a. dutifully
   b. dues
   c. attention
   d. tribute

8. ceremonious occasion
   a. gloomy
   b. formal
   c. cheerful
   d. planned

9. corporate entity
    a. separate individual
    b. president
    c. attorney
    d. policy

10. perpetual motion
    a. circular
    b. slow
    c. constant
    d. interrupted

11. enshrinement of a loved one
    a. holding sacred
    b. less
    c. denial
    d. burial

12. overt behavior
    a. understandable
    b. not hidden
    c. proper
    d. unacceptable

13. infatuated adolescent
    a. carried away by shallow love
    b. extremely studious
    c. fun-loving
    d. rebellious

14. Spartan characteristics
    a. masculine
    b. noble
    c. justifiable
    d. brave

15. poignant story
    a. well-written
    b. violent
    c. mysterious
    d. touching, sensitive

16. impending disaster
    a. terrible
    b. soon to occur
    c. unpreventable
    d. past

17. affirmation of love
    a. disagreement
    b. confirmation
    c. denial
    d. justification

Vocabulary List

Passage C--"Filboid Studge"

The words listed below are found in the following passage. Since their definitions may aid you in the understanding of the passage, you may refer to them at anytime during your reading.

1. faltering--unsure; uncertain
2. fatuous--foolish
3. fulsome--too much; excessive
4. frivolity--silliness
5. unpalatable--not tasty or appetizing
6. ostentatiously--showy
7. countermand--to call back
8. sombre--gloomy; depressing
9. shoals--groups; crowds
10. austerity--stern or forbidding
11. cavil--to object to something
12. presumption--jump to a conclusion
13. battered--broken; damaged
14. epigram--a witty statement
15. mortify--to embarrass; shame

Vocabulary Pretest

Passage C--"Filboid Studge"

1. faltering statement
   a. truthful
   b. uncertain
   c. positive
   d. brief

2. fatuous idea
   a. amazing
   b. innovative
   c. practical
   d. foolish

3. fulsome praise
   a. excessive
   b. sincere
   c. undeserved
   d. little

4. idle frivolity
   a. laughter
   b. silliness
   c. friendship
   d. spending

5. unpalatable food
   a. not desirable
   b. not fresh
   c. not cooked
   d. not tasty

6. ostentatiously wealthy
   a. showy
   b. untruthfully
   c. secretly
   d. suddenly

7. countermand an order
   a. to justify
   b. to write
   c. to give
   d. to call back

8. a sombre mood
   a. cheerful
   b. loving
   c. gloomy
   d. nasty

9. shoals of people
   a. crowds
   b. friends
   c. enemies
   d. names

10. grim austerity
   a. truthfulness
   b. luxury
   c. stern or forbidding
   d. deceitfulness

11. to cavil continuously
   a. praise when it is not deserved
   b. object to something trivial
   c. spend extravagantly
   d. be foolish

12. to make a presumption
   a. jumping to a conclusion
   b. suggestion
   c. public display
   d. correct forecast

13. the battered automobile
   a. stolen
   b. repaired
   c. new
   d. damaged

14. to write an epigram
   a. poem
   b. epitaph
   c. witty statement
   d. final will

15. to mortify my friend
   a. lie to
   b. shame
   c. ignore
   d. help

"Filboid Studge, the Story of a Mouse that Helped"

by

H.H. Munro

"I want to marry your daughter," said Mark Spayley with faltering eagerness. "I am only an artist with an income of two hundred a year, and she is the daughter of an enormously wealthy man, so I suppose you will think my offer a piece of presumption."

Duncan Dullamy, the great company inflator, showed no outward sign of displeasure. As a matter of fact, he was secretly relieved at the prospect of finding even a two-hundred-a-year husband for his daughter Leonore. A crisis was rapidly rushing upon him, from which he knew he would emerge with neither money nor credit; all his recent ventures had fallen flat, and the flattest of all had gone the wonderful new breakfast food, Pipenta, on the advertisement of which he had sunk such huge sums. It could scarcely be called a drug in the market; people bought drugs, but no one bought Pipenta.

"Would you marry Leonore if she were a poor man's daughter?" asked the man of phantom wealth.

"Yes," said Mark, wisely avoiding the error of over-protestation. And to his astonishment Leonore's father not only gave his concent, he suggested a fairly early date for the wedding.

"I wish I could show my gratitude in some way," said Mark with genuine emotion. "I'm afraid it's rather like the mouse proposing to help the lion."

"Get people to buy that beastly muck," said Dullamy, nodding savagely at a poster of the despised Pipenta, "and you'll have done more than any of my agents have been able to accomplish."

"It wants a better name," said Mark reflectively, "and something distinctive in the poster line. Anyway, I'll have a shot at it."

Three weeks later the world was advised of the coming of a new breakfast food, heralded under the resounding name of "Filboid Studge." Spayley put forth no pictures of massive babies springing up with fungus-like rapidity under its forcing influence, or of representatives of leading nations of the world scramblind with fatuous eagerness for its possession. One huge sombre poster depicted the Damned in Hell suffering a new torment from their inability to get at Filboid Studge which elegant young fiends held in transparent bowls just beyond their reach. The scene was rendered even more gruesome by a subtle suggestion of the features of leading men and women of the day in the portrayal of the Lost Souls; prominent individuals of both political parties, Society hostesses, well-known dramatic authors and novelists, and distinguished aeroplanists were dimly recognizable in that doomed throng; noted lights of the muscial-comedy stage flickered wanly in the shades of the Infero, smiling rage of baffled effort. The poster bore no fulsome allusions to the merits of the new breakfast food, but a single grim statement ran in bold letters along its base: "They cannot buy it now."

Spayley had grasped the fact that people will do things from a sense of duty which they would never attempt as a pleasure. There are thousands of respectable middle-class men who, if you found them unexpectedly in a Turkish bath, would explain in all sincerity that a doctor had ordered them to take Turkish baths; if you told them in return that you went there because you liked it, they would stare in pained wonder at the frivolity of your motive. In the same way, whenever a massacre of Armenians is reported from Asia Minor, everyone assumes that it has been carried out "under orders" from somewhere or another; no one seems to think that there are people who might like to kill their neighbors now and then.

And so it was with the new breakfast food. No one would have eaten Filboid Studge as a pleasure, but the grim austerity of its advertisement drove housewives in shoals to the grocers' shops to clamour for an immediate supply. In small kitchens solemn pig-tailed daughters helped depressed mothers to perform the primitive ritual of its preparation. On the breakfast-tables of cheerless parlours it was partaken of in silence. Once the womanfolk discovered that it was thoroughly unpalatable, their zeal in forcing it on their households knew no bounds. "You haven't eaten your Filboid Studge!" would be screamed at the appetiteless clerk as he hurried weariedly from the breakfast table, and his evening meal would be prefaced by a warmed-up mess which would be explained as "your Filboid Studge that you didn't eat this morning." Those strange fanatics who ostentatiously mortify themselves inwardly and outwardly, with health biscuits and health garments, battened aggressively on the new food. Earnest spectabled young men devoured it on the steps of the National Liberal Club. A bishop who did not believe in a future state preached against the poster, and a peer's daughter died from eating too much of the compound. A further advertisement was obtained when an infantry regiment mutinied and shot its officers rather than eat the nauseous mess; fortunately, Lord Birrell of Blatherstone, who was War Minister at the moment, saved the situation by his happy epigram, that "Discipline to be effective must be optional."

Filboid Studge had become a household word, but Dullamy wisely realized that it was not necessarily the last word in breakfast dietary; its supremacy would be challenged as soon as some yet more unpalatable food should be put on the market. There might even be a reaction in favour of something tasty and appetizing, and the Puritan austerity of the moment might be banished from domestic cookery. At an opportune moment, therefore, he sold out his interests in the article which had brought him in a collossal wealth at a critical juncture, and placed his financial reputation beyond the reach of cavil. As for Leonore, who was now an heiress on a far greater scale than ever before, he naturally found her something a vast deal higher in the husband market than a two-hundred-a-year poster designer. Mark Spayley, the brainmouse who had helped the financial lion with such untoward effect, was left to curse the day he produced the wonder-working poster.

"After all," said Clovis, meeting him shortly afterwards at his club, "you have this doubtful consolation, that 'tis not in mortals to countermand success.'"

Comprehension Questions

"Filboid Studge, the Story of a Mouse that Helped," by H.H. Munro

1. Mr. Dullamy gave his permission for Mark Spayley to marry is daughter because
   a. he genuinely liked him
   b. he felt Mark would be a good provider for his daughter
   c. he had lost all of his money
   d. he was impressed with Mark's artistic talents

2. One person who ate Filboid Studge
   a. went into a coma
   b. was poisoned
   c. went blind
   d. died

3. The statement "They cannot buy it now," implies that
   a. one would go to hell if s/he did not buy Filboid Studge
   b. people would go mad if they could not buy Filboid Studge
   c. only elite people eat Filboid Studge
   d. people would become ill if they did not eat Filboid Studge

4. Mark's advertisement was a huge poster depicting
   a. would-be starlets and unsuccessful politicians
   b. sinful creatures enjoying themselves
   c. lost souls in hell
   d. people enjoying Filboid Studge

5. It appears that Mark Spayley wanted to marry Leonore becuase
   a. he loved her
   b. he was after her money
   c. he wanted a job in her father's company
   d. he wanted to go into advertising

6. Why did Mr. Dullamy ask Mark Spayley if he would marry a poor man's daughter?
   a. Mr. Dullamy believed that Leonore would soon be a poor man's daughter
   b. Mr. Dullamy wanted to be sure of Mark's intentions
   c. it is the sort of question rich people ask poor people
   d. he was afraid that Mark would try to steal from him

7. Mark and Mr. Dullamy were similar in that they both
   a. were devious
   b. loved Leonore
   c. were successful
   d. were honest

8. After the success of Filboid Studge, Mr. Dullamy
   a. sold his company of r a loss
   b. sold his company at a considerable profit
   c. came out with a new product
   d. made Mark a partner in the firm

9. Mark Spayley was the brainmouse while Mr. Dullamy was the
   a. successful lion
   b. corporate lion
   c. powerful lion
   d. financial lion

10. When Mark stated, "I'm afraid it's rather like the mouse proposing to help the lion," he meant
   a. that he thought he would be able to help
   b. that it was almost useless to try to help
   c. that he was afraid of Mr. Dullamy
   d. that he knew Mr. Dullamy would not want his help

11. What did Mark suggest when Mr. Dullamy asked him to get people to buy Pipenta?
   a. the product needed a better name and more distinctive advertising display
   b. he suggested that Mr. Dullamy hire an advertisting firm
   c. he suggested a more appetizing product
   d. he thought Mr. Dullamy should take his loss and come up with a new product

12. In the end, Mark Spayley cursed the day he came up with the poster because
   a. Mr. Dullamy paid him nothing for it
   b. he lost Leonore
   c. it made him too famous
   d. it had not been the moral thing to do

13. The "mouse" in this story was
   a. Leonore
   b. Mark
   c. Mr. Dullamy
   d. those who at Filboid Studge

14. Which of the following was not depicted in Mark's poster?
   a. famous personalities
   b. suffering
   c. bowls of Filboid Studge
   d. the nutritional value of Filboid Studge

15. Which would best describe Mr. Dullamy?
   a. witty, protective, sly
   b. stingy, easy-going, snobbish
   c. frivolous, moral, smart
   d. cunning, wealthy, callous

16. In the beginning, no one bought Pipenta because it
    a. was too expensive
    b. was poorly advertised
    c. made people sick
    d. tasted terrible

17. Pipenta was
    a. a cereal
    b. a soup
    c. a snack
    d. a dessert

18. What was the reasoning behind Mark's advertising?
    a. people like to identify with well-known personalities
    b. people act out of a sense of duty
    c. people act out of a desire for pleasure
    d. people buy what is advertised

Retention Questions

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   2. it was the sort of question rich people ask poor people
   3. he was afraid that Mark would try to steal from him
   4. Mr. Dullamy wanted to be sure of Mark's intentions

10. What did Mark suggest when Mr. Dullamy asked him to get people to buy Pipenta?
    1. the product needed a better name and more distinctive advertising display
    2. he thought Mr. Dullamy should take his loss and come up with a new product
    3. he suggested that Mr. Dullamy hire an advertising firm
    4. he suggested a more appetizing product

11. Mark Spayley was the brainmouse while Mr. Dullamy was the
    1. corporate lion
    2. powerful lion
    3. successful lion
    4. financial lion

12. Mr. Dullamy gave his permission for Mark Spayley to marry his daughter because
    1. he had lost all of his money
    2. he felt Mark would be a good provider for his daughter
    3. he was impressed with Mark's artistic talents
    4. he genuinely liked him

13. One person who ate Filboid Studge
    1. went into a coma
    2. went blind
    3. died
    4. was poisoned

14. When Mark stated, "I'm afraid it's rather like the mouse proposing to help the lion," he meant
    1. that he was afraid of Mr. Dullamy
    2. that he thought he would be able to help
    3. that he knew Mr. Dullamy would not want his help
    4. that it was almost useless to try to help

15. Mark and Mr. Dullamy were similar in that they both
    1. were devious
    2. were honest
    3. loved Leonore
    4. were successful

16. Which of the following was not depicted in Mark's poster?
    1. the nutritional value of Filboid Studge
    2. bowls of Filboid Studge
    3. suffering
    4. famous personalities

17. Pipenta was a
    1. snack
    2. soup
    3. dessert
    4. cereal

18. Mark's advertisement was a huge poster depicting
    1. sinful creatures enjoying themselves
    2. would-be starlets and unsuccessful politicians
    3. people enjoying Filboid Studge
    4. lost souls in Hell

Vocabulary Posttest

Passage C--"Filboid Studge"

1. a sombre mood
   a. nasty
   b. gloomy
   c. loving
   d. cheerful

2. shoals of people
   a. crowds
   b. enemies
   c. names
   d. friends

3. to make a presumption
   a. suggestion
   b. jumping to a conclusion
   c. correct forecast
   d. public display

4. fulsome praise
   a. sincere
   b. little
   c. undeserved
   d. excessive

5. the battered automobile
   a. broken
   b. new
   c. repaired
   d. stolen

6. to write an epigram
   a. epitaph
   b. final will
   c. poem
   d. witty statement

7. to mortify my friend
   a. help
   b. shame
   c. lie to
   d. ignore

8. idle frivolity
   a. silliness
   b. friendship
   c. laughter
   d. spending

9. grim austerity
   a. luxury
   b. deceitfulness
   c. truthfulness
   d. stern or forbidding

10. unpalatable food
   a. not fresh
   b. not desirable
   c. not tasty
   d. not cooked

11. countermand an order
   a. to call back
   b. to give
   c. to write
   d. to justify

12. to cavil continuously
   a. be foolish
   b. spend extravagantly
   c. praise when it is not deserved
   d. object to something trivial

13. ostentatiously wealthy
   a. secretly
   b. showy
   c. suddenly
   d. untruthfully

14. faltering statement
   a. brief
   b. positive
   c. undertain
   d. truthful

15. fatuous idea
   a. foolish
   b. innovative
   c. practical
   d. amazing

NAME ______________________________ Group I D C (circle one)

QUESTIONNAIRE

1. Did you form images in your mind when reading the passages?

YES NO

2. Did you form images in your mind when answering the comprehension questions?

YES NO

3. Did you form images in your mind when answering the retention questions?

YES NO

4. If you had to rank the three passages according to the ease that they were imaginal, how would you rank them? Put 1 for the passage that was the easiest to image, 2 for the passage that was the next easiest to image, and 3 for the passage that was the most difficult to image.

_____"The Long, Cold Sleep"
_____"Filboid Studge"
_____"The Immortality Syndrome"

5. Rank the three passages according to the ease that you understood them.

_____"Filboid Studge"
_____"The Long, Cold Sleep"
_____"The Immortality Syndrome"

6. If you did not use imagery on the three passages, what technique/s did you use to comprehend the passages? Mark as many as apply.

_____ Rereading
_____ Summarizing
_____ Paraphrasing
_____ Other
_____ Saying important material to yourself
_____ Saying important materials out loud
_____ I used no techniques that I was aware of

7. If you did not use imagery to aid you in the retention of the passages, what technique/s did you use?

_____ Paraphrasing
_____ Saying important material to yourself
_____ Saying important material out loud
_____ I used no techniques that I was aware of
_____ Other

APPENDIX B

POINT BISERIAL VALUES FOR THE COMPREHENSION QUESTIONS

Point Biserial Values (r_{pbi}) for 18 Comprehension Items
Passage A--"A Long, Cold Sleep"

Item	r_{pbi}
1	.69
2	.35
3	.33
4	.45
5	.61
6	.52
7	.52
8	.28
9	.36
10	.58
11	.50
12	.42
13	.37
14	.22
15	.26
16	.33
17	.56
18	.28

Point Biserial Values (r_{pbi}) for 18 Comprehension Items
Passage B-"Immortality Syndrome"

Item	r_{pbi}
1	.31
2	.29
3	.34
4	.47
5	.41
6	.45
7	.32
8	.41
9	.72
10	.31
11	.47
12	.42
13	.22
14	.57
15	.52
16	.39
17	.41
18	.39

Point Biserial Values (r_{pbi}) for 18 Comprehension Items
Passage C--"Filboid Studge, the Story of a Mouse That Helped"

Item	r_{pbi}
1	.46
2	.28
3	.47
4	.49
5	.35
6	.44
7	.37
8	.50
9	.35
10	.53
11	.43
12	.22
13	.45
14	.36
15	.41
16	.31
17	.34
18	.49

APPENDIX C

SPECIFIC TEACHING INSTRUCTIONS FOR IMAGERY GROUP AND DIRECTED READING ACTIVITY GROUP FOR EACH PASSAGE ON THE ICAT

"Warm-up" Words for Imagery Group

"Warm-up" words used for teaching each passage in the ICAT to the imagery group were as follows:

Passage A -"The Long, Cold Sleep"by Harold Schmeck, a biological science passage

1. hibernation
2. sleep
3. surgery
4. energy

Passage B -"Immortality Syndrome"by James Gollin, a social science passage

1. death
2. money
3. life
4. insurance

Passage C -"Filboid Studge, the Story of a Mouse that Helped,"by H. H. Munro, a literature passage

1. love
2. wealth
3. devious
4. poster

Directed Reading Activity

Passage A -"The Long, Cold Sleep"

Motivation and background. In order to provide background information the following questions were asked and discussion ensued concerning possible answers:

1. What is hibernation?
2. Why do animals hibernate? What purposes do you think it serves?
3. Scientists know very little about hibernation. Why do you think this is so?
4. Can you think of any ways that the hibernation process might be applied to humans if more was known about it?

Purpose setting. The researcher asked the subjects to indicate what they would expect to learn from an article entitled The Long, Cold Sleep. Some of the responses were as follows:

1. What animals hibernate?
2. How long do animals hibernate?
3. What happens to animals during hibernation?
4. Why do some animals hibernate while others do not?

The researcher indicated that the questions formulated by the students were good ones and they might additionally keep in mind the following:

1. Do only animals that live in a cold climate hibernate?
2. Why don't scientists know much about hibernation?
3. How might hibernation be scientifically studied in the future?
4. What is hypothermia? How is it like hibernation?

Directed Reading Activity

Passage B -"Immortality Syndrome"

Motivation and background. In order to provide background information and motivation the following questions were asked and discussion ensued:

1. How many of you (or your parents) have life insurance policies?
2. Why do you (or your parents) have them?
3. What purposes do life insurance policies serve?
4. How do most people feel about dying? Do they think it will happen to them?
5. The discussion of death often results in a fear producing situation. Why do you think this is so?
6. What does the word "immortality" mean?
7. What does the term "syndrome" mean?

Purpose setting. The researcher stated, "This passage deals with the topic of death as a majority of Americans view it. As you read it, compare your feelings on death to those expressed in the article. Think about ways in which you flirt with death every day." They were also instructed to read for answers to the following questions:

1. How do life insurance companies package death?
2. Why is James Bond discussed in this passage?
3. How are death and money related?
4. How do Americans deal with grief?
5. Why is death referred to as "an industry"?

Directed Reading Activity

Passage C -"Filboid Studge, the Story of a Mouse that Helped"

Motivation and background. In order to provide background and motivation the following questions were asked and discussion ensued concerning possible answers:

1. How many of you know people who are wealthy?
2. How do they differ (if they do) in what is important to them?
3. If your family had a lot of money do you think they would want you to marry someone poor? Why or why not?
4. Pretend you are very poor. (Someone stated "I don't have to pretend!") You are in love with someone who is wealthy. You want to show that your intentions are good ones. How might you impress or win over your beloved's family?

Purpose setting. The researcher stated that in the selection a fellow called Mark, a poor man, finds himself in love with Leonore, a rich girl. Read to find out if he wins Leonore. Also read to answer the following questions:

1. What does "Filboid Studge" have to do with the plot of the story?
2. Look at the title. What does it mean?
3. What kind of a man was Leonore's father? Think of at least three words to describe him.
4. What caused the success of Filboid Studge?
5. Would you have bought it? Why or why not?

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BIOGRAPHICAL SKETCH

Sherrie Lee Nist was born in Pittsburgh, Pennsylvania, on October 3, 1946. She graduated from South Park High School in 1964 and received her Bachelor of Science in elementary education from California State College, California, Pennsylvania, in 1967. After teaching third grade for one year in New Bethlehem, Pennsylvania, she moved to Titusville, Florida, where she taught first grade for four years. She moved to Daytona Beach, Florida, where she worked for two years as a diagnostician/remedial reading instructor in a private clinic. She then worked for one and a half years with disadvantaged youths having reading problems. Just prior to entering graduate school she implemented and maintained a reading laboratory at Embry-Riddle Aeronautical University in Daytona Beach, Florida. Realizing unfulfilled goals, she applied and was accepted in the graduate program at the University of Florida in 1979 where she completed both a Master of Education and a Doctor of Philosophy in reading. During this period she was a graduate assistant for both the Office of Instructional Resources where she taught developmental reading to college students and the Department of Instructional Leadership and Support where she taught undergraduate reading courses.

She has currently accepted the position of Reading Coordinator for the Department of Developmental Studies at the University of Georgia.

She has one daughter, Kama Lenore, aged 12.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Ruthellen Crews

Ruthellen Crews, Chairperson
Professor of Instructional Leadership
and Support

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

John M. Newell

John M. Newell
Professor of Foundations of Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Stephen F. Olejnik

Stephen F. Olejnik
Assistant Professor of Foundations of
Education

This dissertation was submitted to the Graduate Faculty of the Division of Curriculum and Instruction in the College of Education and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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Dean for Graduate Studies and Research